a6 cont. MAP, CVP and CO indicators in the same manner as vascular resistor objects 58 and 76 of Figure 4.

Please replace the paragraph [0102] with the following rewritten paragraph:

a7 **[0102]** In an one embodiment, all of the information of extended heart object 2 is incorporated into the Vascular Circuit Object 52 in Figure 4 and can be displayed. This information could be accessed or suppressed at the desire of the user.

REMARKS

Applicant hereby submits this preliminary amendment amending the priority claim and the specification. Applicant has amended the priority claim in accordance with 35 USC §120. Amendments to the specification were to correct inadvertant mistakes and applicant apologizes for any inconvenience this may have caused. If there are any questions concerning this preliminary amendment, please call the undersigned at the number stated below.

Respectfully submitted,

Dated: 4/30/02

John Wurst
Registration No. 40,283
(858) 410-5174

VERSION WITH MARKINGS

[0001] This application claims priority under 35 U.S.C. § 120 to U.S. Serial No. 09/706,512 filed on November 3, 2000 and Provisional Patent Application Serial No. 60/263,861 filed on ~~January 19, 2000~~ January 23, 2001.

[0079] In the ~~Extendedheart~~ extended heart object, the RA, RV, LA and LV of the heart can expand or contract to show the filling state of the individual chambers. For example, in Figure 2, the RV 8 and the LV 12 are in a filled state. This is demonstrated by the outward bulging of the individual chambers. If the filling pressures were low, the CVP and PCWP meters would point inwards and the display would show the RV and LV chambers to be scalloped inwards. The shape of the chambers conveys the status of FULL vs EMPTY. Located in-between the RA 6 and the RV 8 on the far left is a CVP meter 47 which moves in conjunction with the filling state of the RV 8. For example, if the RV is overfilled, the CVP meter 47 moves from the twelve o'clock position toward the eleven o'clock position or beyond. If the RV is under filled (not shown), the CVP meter moves from the twelve o'clock position to the one o'clock position or beyond. At the bottom of the LV chamber is the PCWP meter 48 which, like the CVP meter 47, moves according to the filling state of the LV 12.

[0082] In the middle of the ~~Extendedheart~~ extended heart object 4 is a bold vertical line representing the septum 34. In the middle of the septum 34 is an oval shaped object 36 which represents the Atrio-ventricular node (AV-Node) and is intersected by the ventricular bundle (bundle of His 22). To the left of the septum 34 in the RV 8 is an elongated, rectangular shaded box 38 which represents the compliance state of the right ventricle. A reference box depicting the normal width is the same as the shaded box and therefore not visible. To the right of the septum 34 in the LV 12 are two vertically oriented rectangular, shaded boxes 40A and 40B, which illustrates non-compliant left ventricle because the shaded area extends beyond the reference box width that conveys the normal compliance state. Greater than normal compliance would be shown as a shaded area narrower than the reference box. Typically the reference box would be

shown in a different color, such as purple, that would make it easy to see the patient state relative to the normal. As noted, to the left of the septum 34 is an another elongated, rectangular shaded box 38 and this represents a normal right ventricle. The RV and LV can be represented as being of normal, increased or decreased compliance.

[0084] Below LV 12 and extending from the ~~Extendedheart~~ extended heart object 4 is an example of stenosis of the aortic valve 44. The one arrow extending from the aortic valve 44 shows obstructed blood flow. Separating the aortic valve 44 and the LV 12 are two, side-by-side, bolded, horizontally oriented rectangles 46A and 46B which represent a thickened aortic valve. Thickening of any valve would be shown in the same manner. The ~~Extendedheart~~ extended heart object 4 of the present invention mimics the human heart and displays information in an intuitive manner to physicians or other medical personnel allowing for the display of a large quantity of information in a simplified manner.

[0085] Referring now to Figure 3, the process of updating the ~~Extendedheart~~ extended heart object begins when a start signal is transmitted by the user at start state 5. The start signal can be a keystroke or a mouse command that initiates the software to begin collecting data. After receiving the start command at state 5, the process moves to a state 7 where the stroke volume ("SV") is read. The stroke volume can be read from a table or a buffer in the computer system. After the SV is read, the process moves to a state 9 where the heart rate ("HR") is read.

[0099] An alternative embodiment of the vascular circuit is shown in Figure 5. In this embodiment, the ~~Extendedheart~~ extended heart object is omitted. In its place is an abbreviated heart object showing only the right ventricle ("RV") object 86. Blood flow is indicated by an arrow between the cell/tissue object 84 and RV object 86. In this embodiment, the chambers of the heart are split with the LV 96 downstream. Blood flow leaves RV 86 and enters into a pulmonary vascular resistor object 88 which functions in the same manner as vascular resistor object 58 of Figure 4. Vascular resistor object 88 is used to display the blood flow equivalent to Ohm's law and the data is visually displayed in the form of object 58 as a "pipe" shaped object wherein blood flow is from right to left. The area inside the pipe can be darkened to represent the

represent the inflow of blood into the pipe and to aid visually. Both vascular resistance objects of Figure 5 can have a MAP, CVP and CO indicators in the same manner as vascular resistor objects 58 and 76 of Figure 4.

[0102] In an one embodiment, all of the information of ~~Extendedheart~~ extended heart object 2 is incorporated into the Vascular Circuit Object 52 in Figure 4 and can be displayed. This information could be accessed or suppressed at the desire of the user.

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w/ Red Markings

Figure 2

Fig. 1

2

FIG. 2

Figure 2

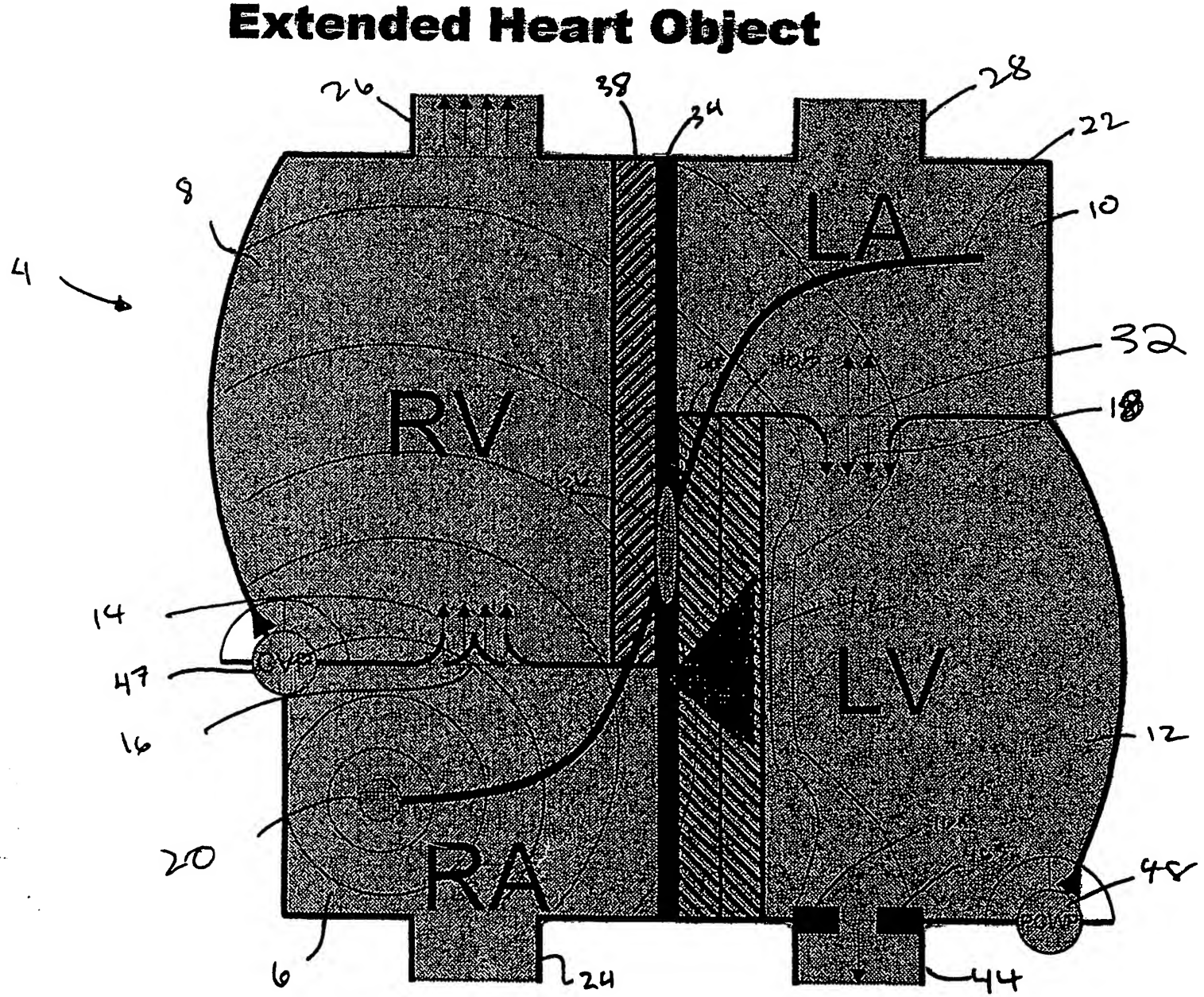

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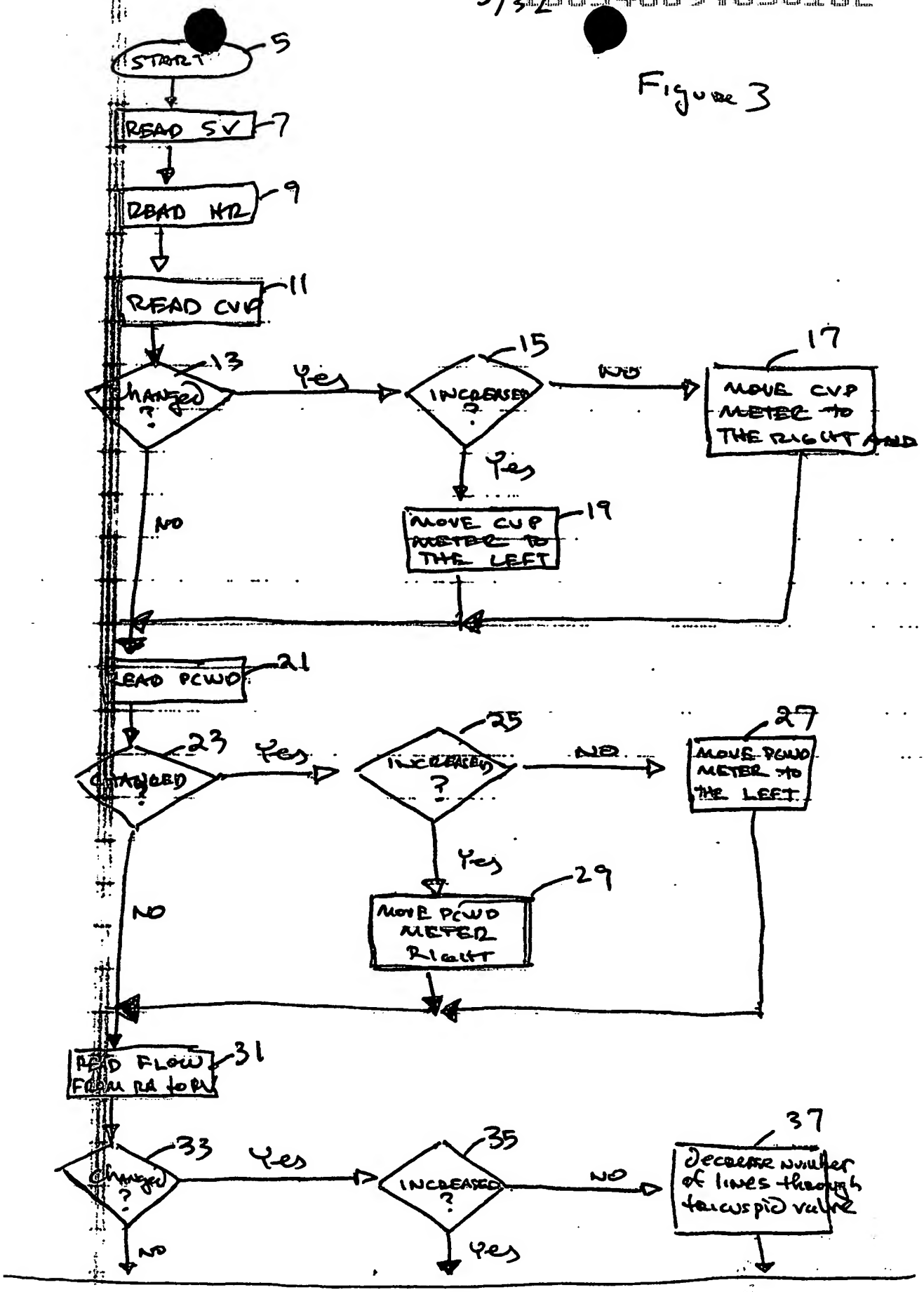
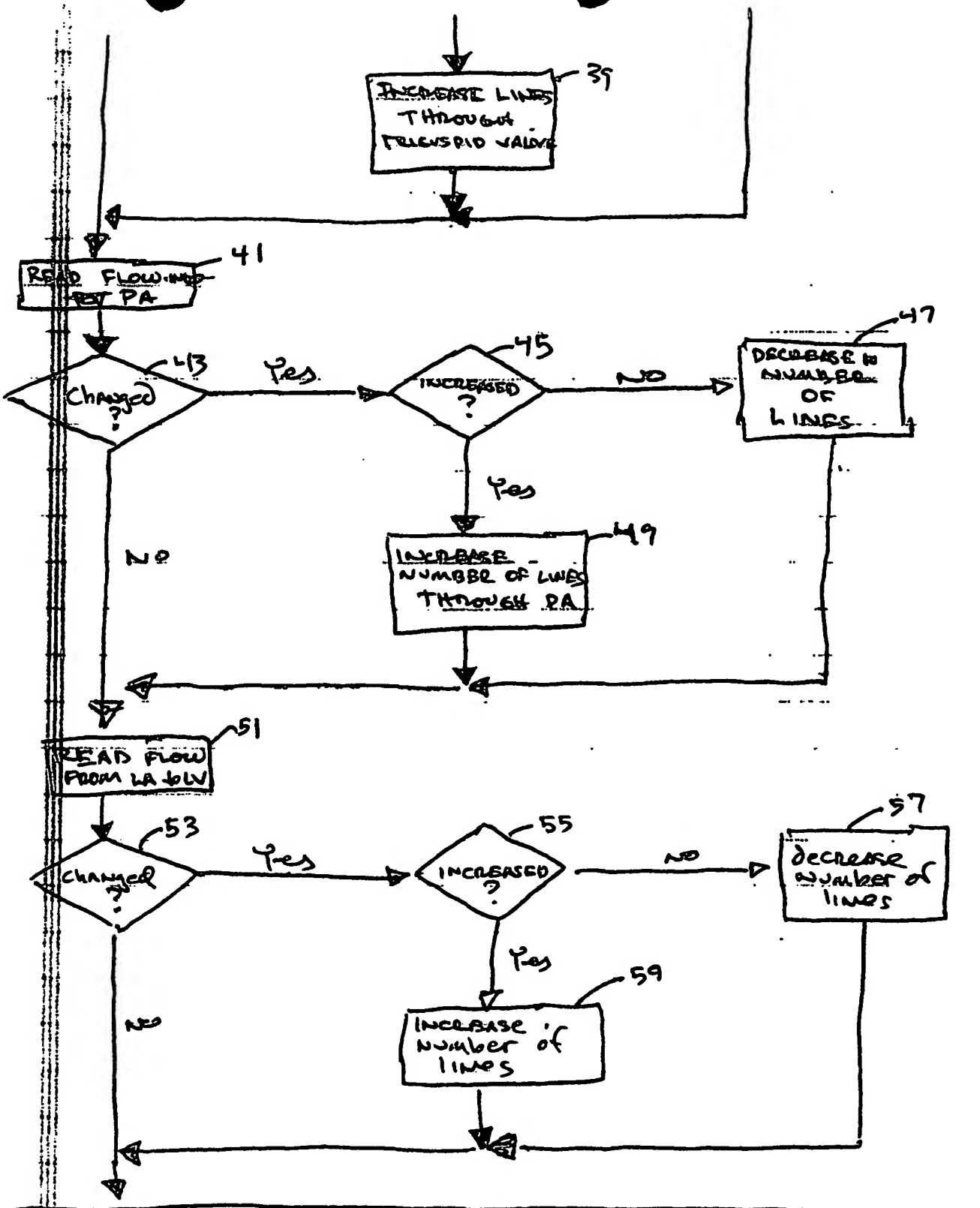
Figure 3


START
5
READ SV
7
READ HR
9
READ CVP
11
CHANGED ?
13
Yes
INCREASED ?
15
NO
MOVE CVP METER TO THE RIGHT
17
Yes
MOVE CVP METER TO THE LEFT
19
NO
READ PCWD
21
CHANGED ?
23
Yes
INCREASED ?
25
NO
MOVE PCWD METER TO THE LEFT
27
Yes
MOVE PCWD METER RIGHT
29
NO
READ FLOW FROM RA TO RV
31
CHANGED ?
33
Yes
INCREASED ?
35
NO
Decrease number of lines through tricuspid valve
37
NO
Yes


INCREASE LINES THROUGH FEEDBACK VALVE
39
READ FLOW PA
41
CHANGED ?
43
Yes
INCREASED ?
45
NO
DECREASE NUMBER OF LINES
47
Yes
INCREASE NUMBER OF LINES THROUGH PA
49
NO
READ FLOW FROM LA & LV
51
CHANGED ?
53
Yes
INCREASED ?
55
NO
decrease number of lines
57
Yes
INCREASE number of lines
59
NO

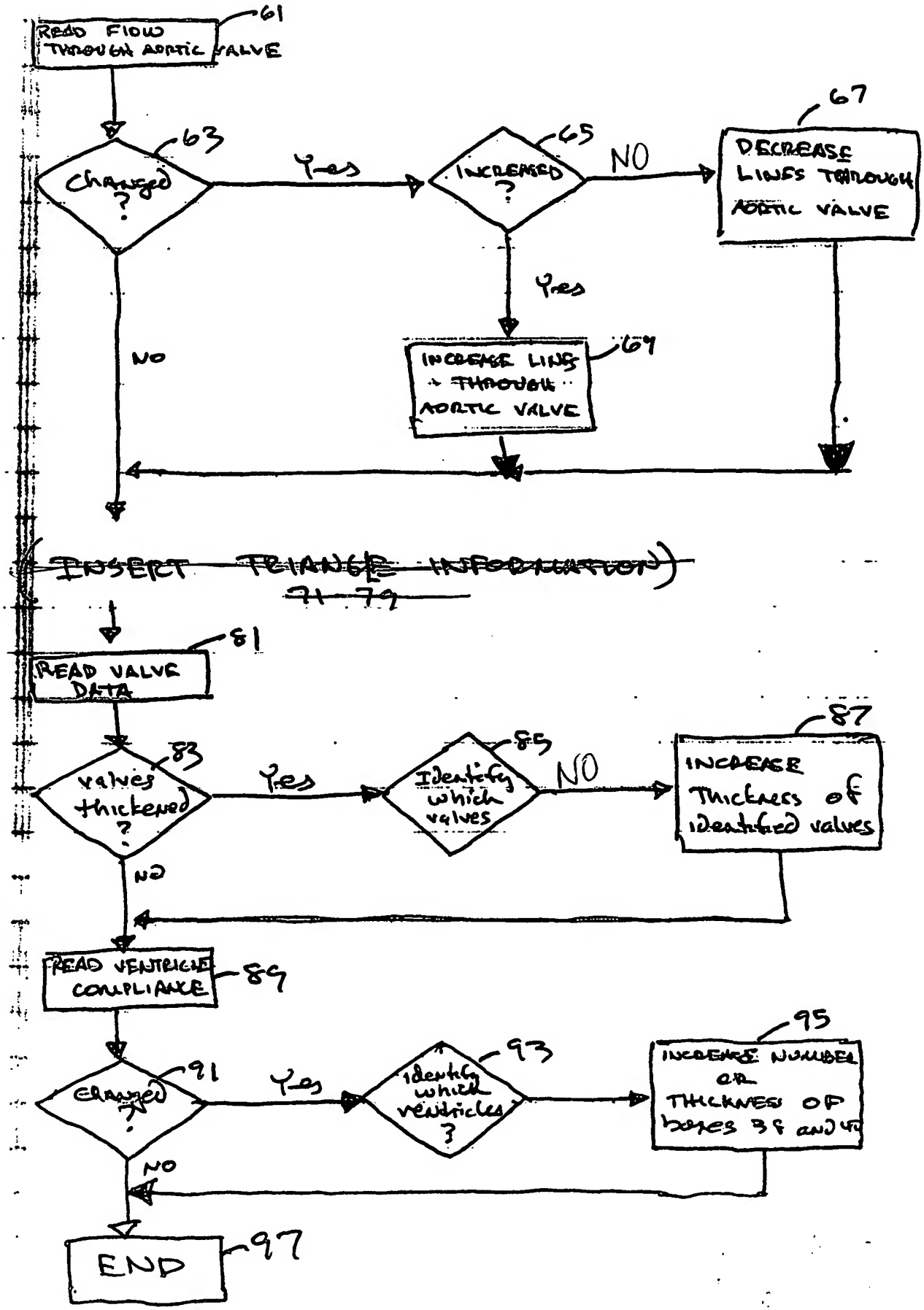

READ FLOW THROUGH AORTIC VALVE
61
Changed ?
63
Yes
INCREASED ?
65
NO
DECREASE LINES THROUGH AORTIC VALVE
67
Yes
NO
INCREASE LINS THROUGH AORTIC VALVE
69
INSERT TRIANGLE INFORMATION
71 79
READ VALVE DATA
81
Valves thickened ?
83
Yes
Identify which valves
85
NO
INCREASE Thickness of identified valves
87
NO
READ VENTRICLE COMPLIANCE
89
Changed ?
91
Yes
Identify which ventricles ?
93
INCREASE NUMBER OR THICKNESS OF boxes 88 and 90
95
NO
END
97

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Fig. 4

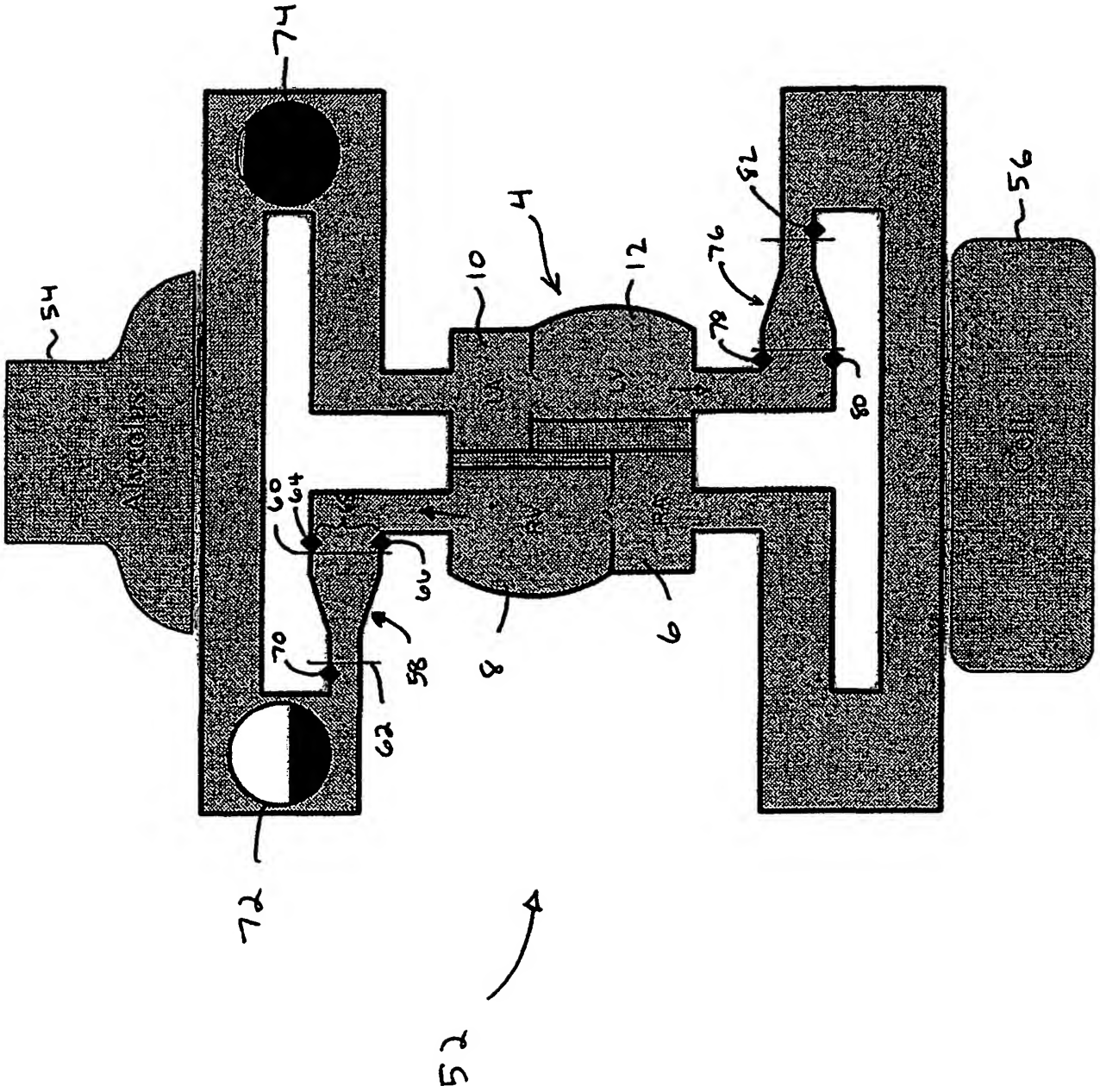

Fig. 5

Vascular Circuit (split RV and LV version)

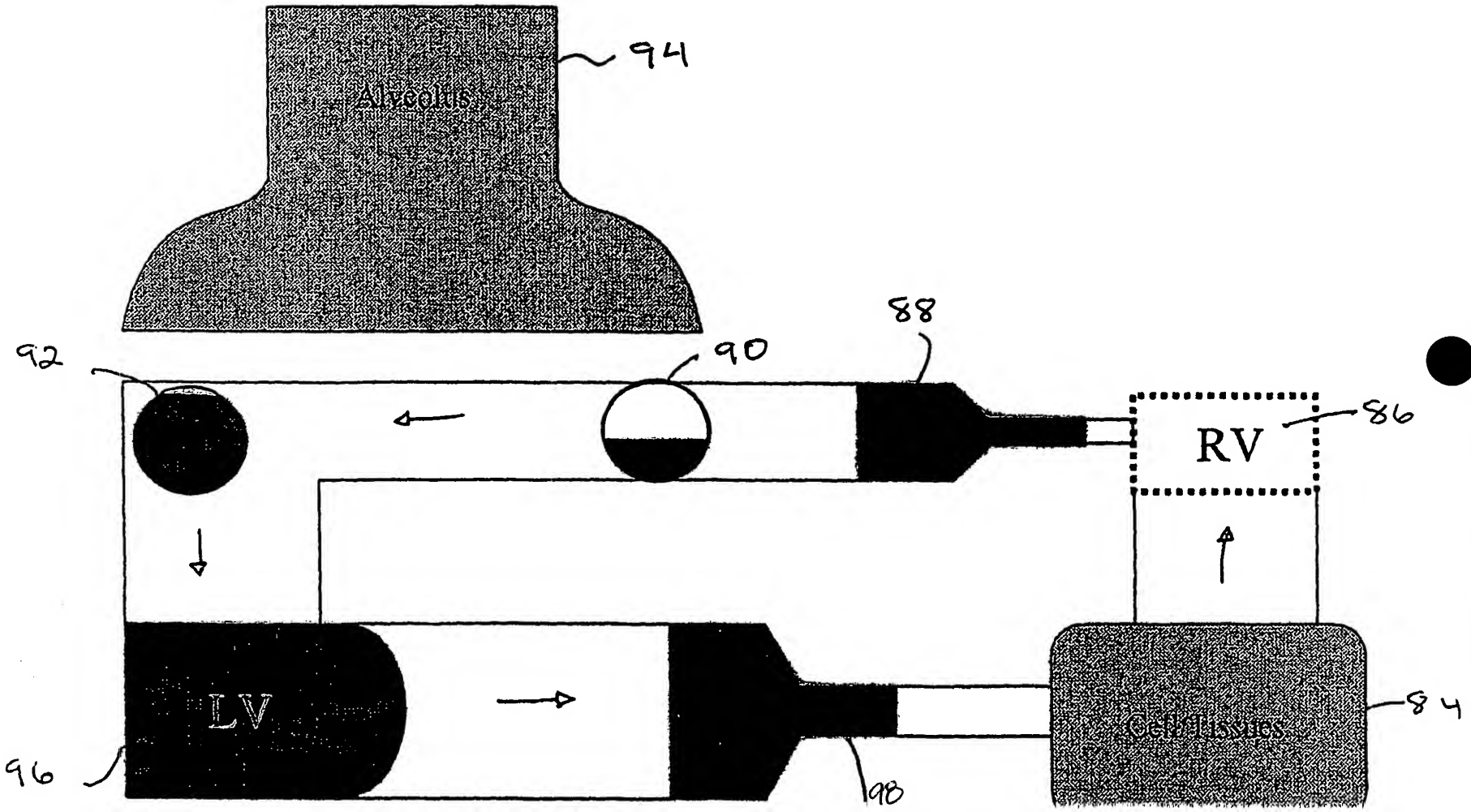

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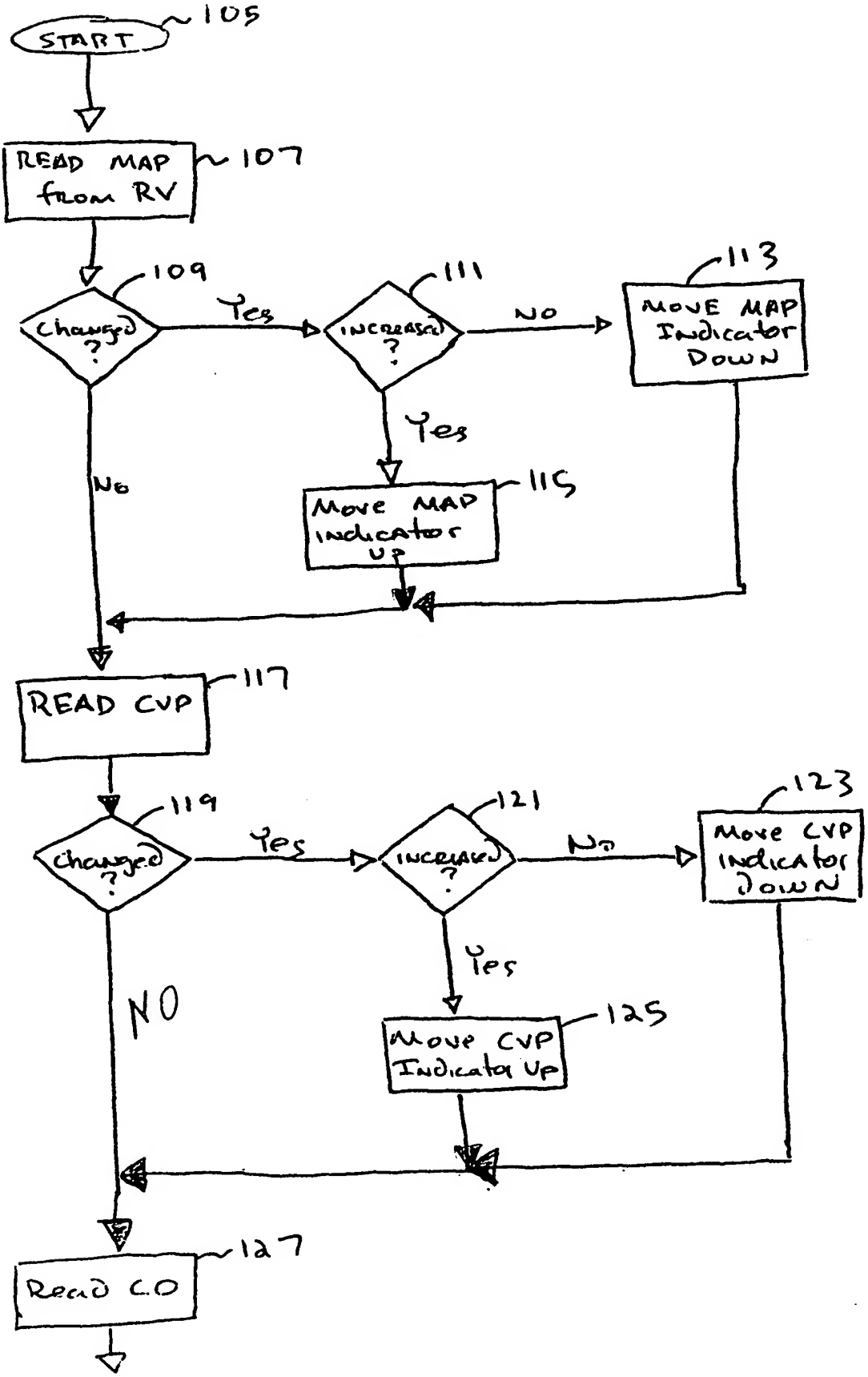
Fig. 6


START
105
READ MAP from RV
107
Changed ?
109
Yes
INCREASED ?
111
NO
MOVE MAP Indicator DOWN
113
Yes
No
Move MAP Indicator UP
115
READ CVP
117
Changed ?
119
Yes
INCREASED ?
121
No
Move CVP Indicator DOWN
123
Yes
NO
Move CVP Indicator Up
125
Read CO
127

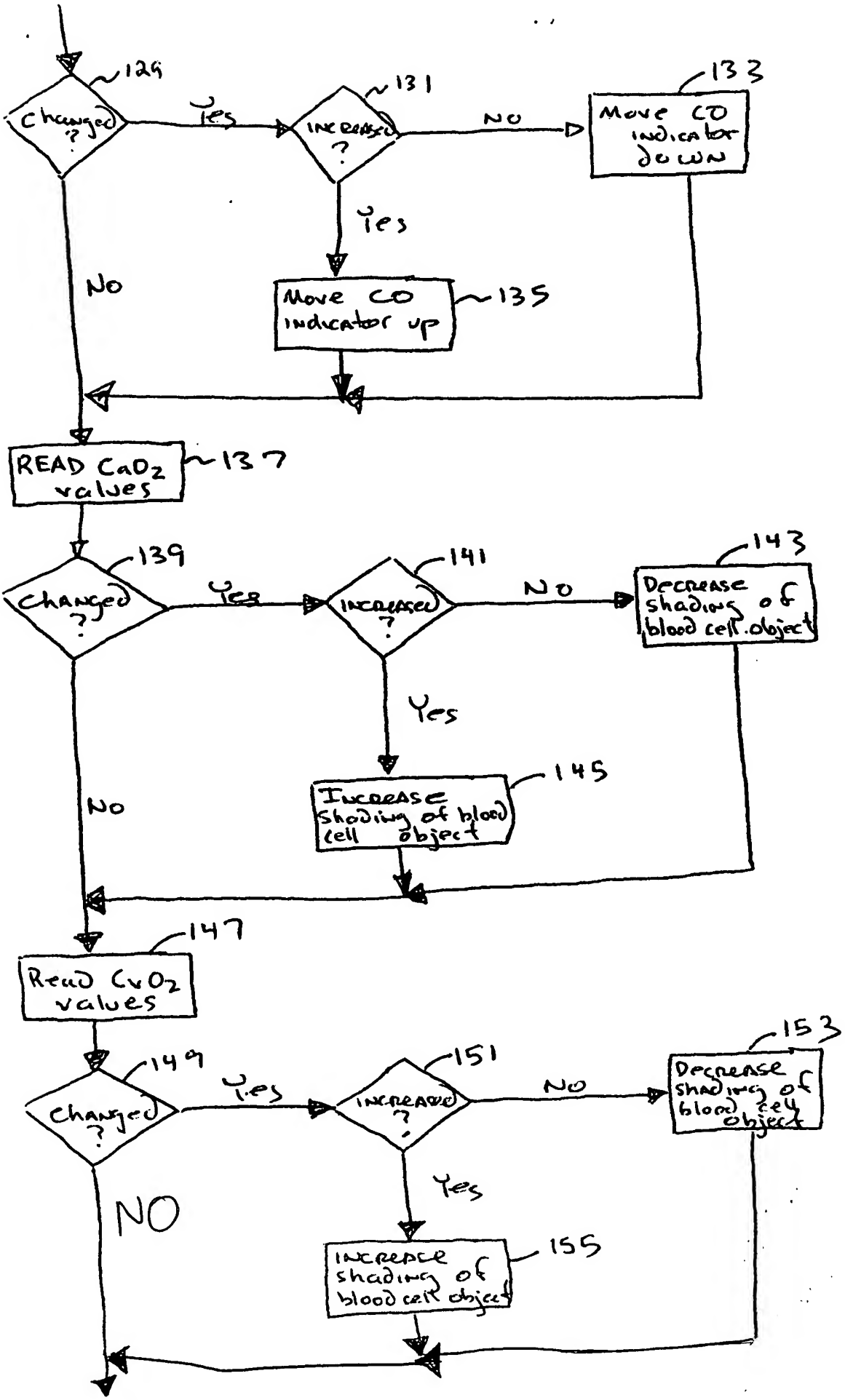

129
Changed ?
Yes
131
INCREASED ?
NO
133
Move CO indicator DOWN
Yes
No
Move CO indicator up
135
READ CaO_2 values
137
139
CHANGED ?
Yes
141
INCREASED ?
NO
143
Decrease shading of blood cell object
Yes
No
INCREASE shading of blood cell object
145
147
Read CvO_2 values
149
CHANGED ?
Yes
151
INCREASED ?
NO
153
Decrease shading of blood cell object
Yes
NO
INCREASE shading of blood cell object
155

Fig. 7

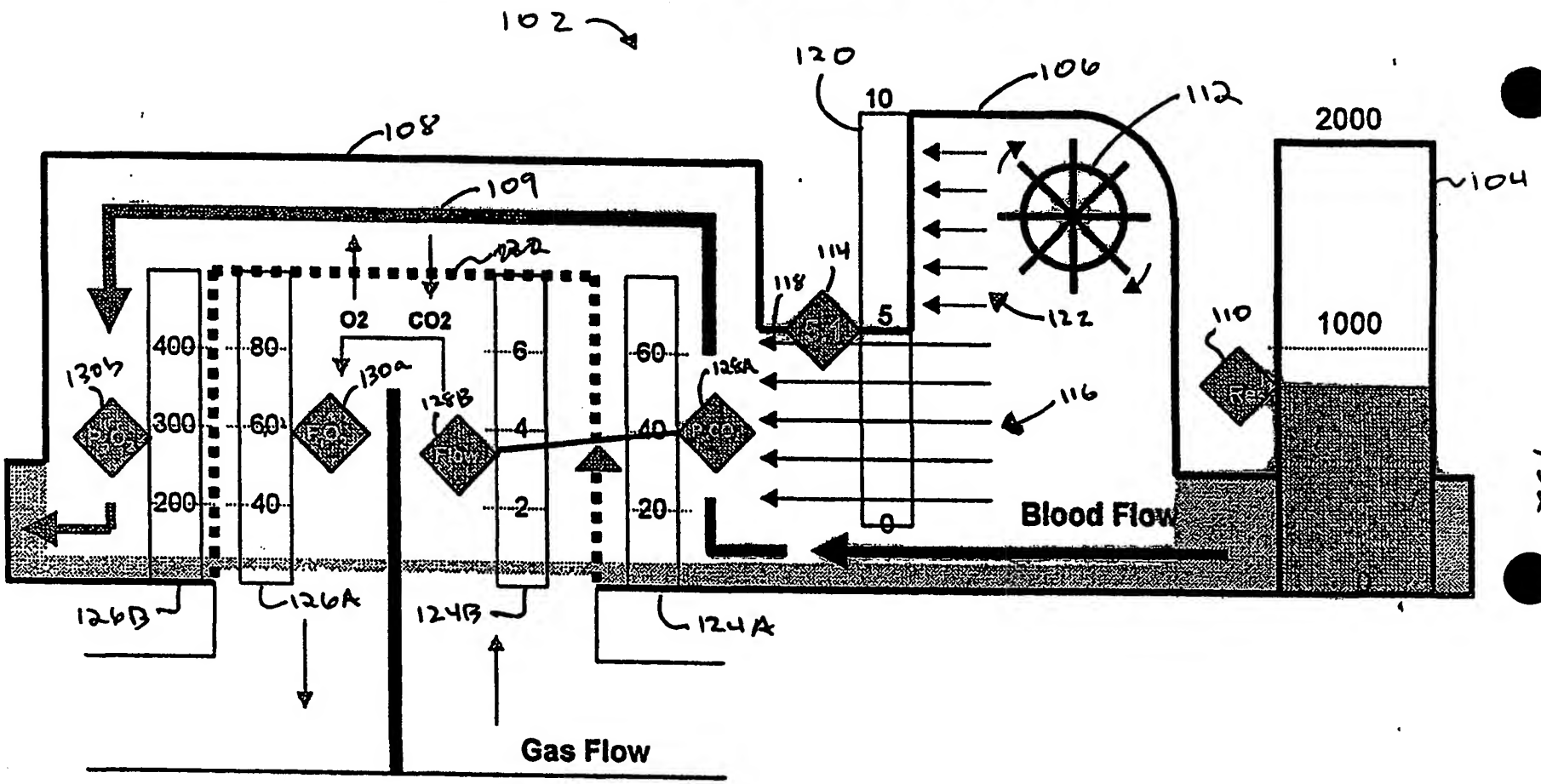

Cardiopulmonary Bypass Object
102
120
106
112
108
10
2000
104
109
122
114
118
5
110
1000
O2
CO2
400
80
6
60
130b
130a
128A
128B
300
60
4
40
116
200
40
2
20
0
Blood Flow
126B
126A
124B
124A
Gas Flow

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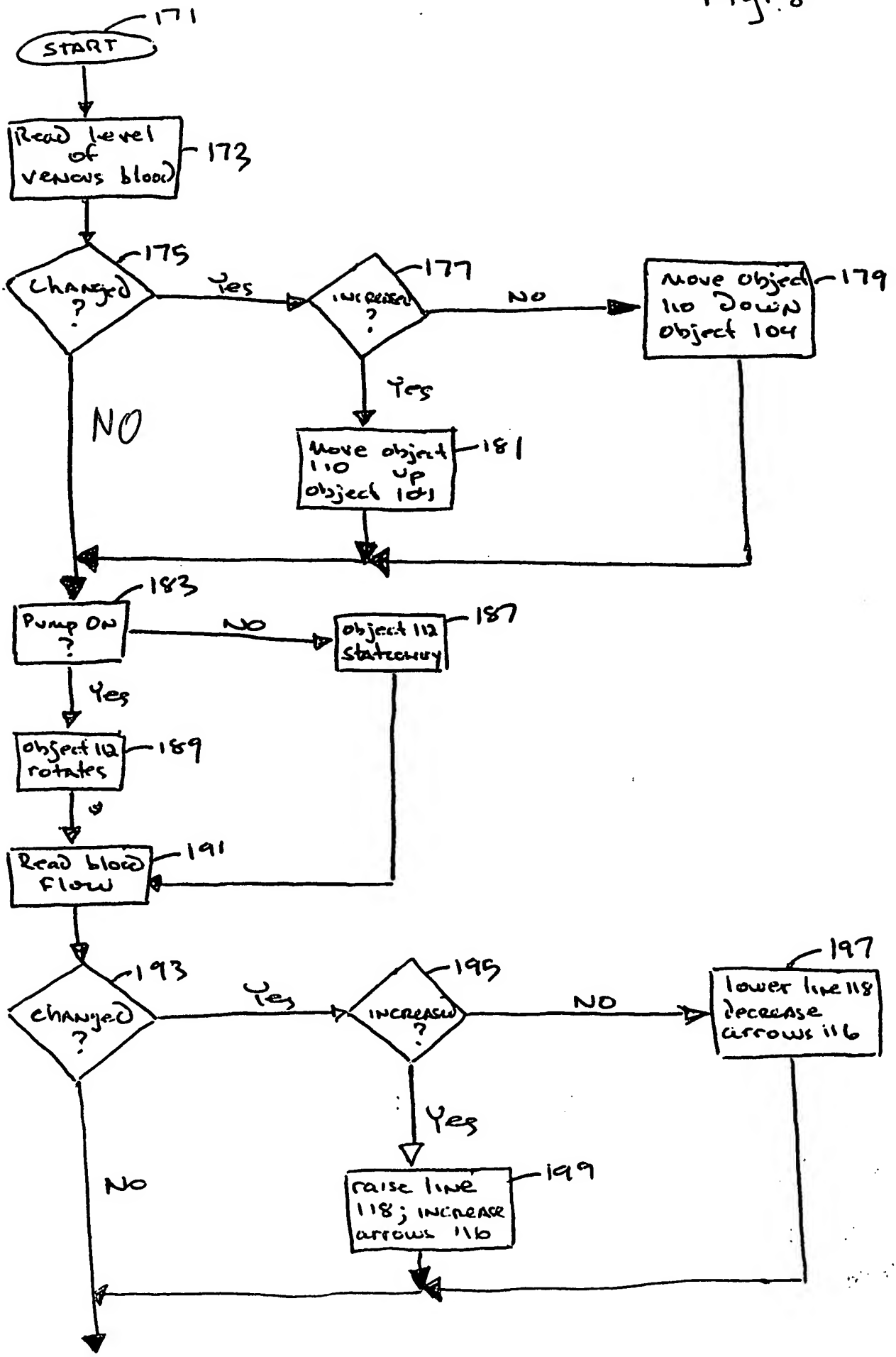
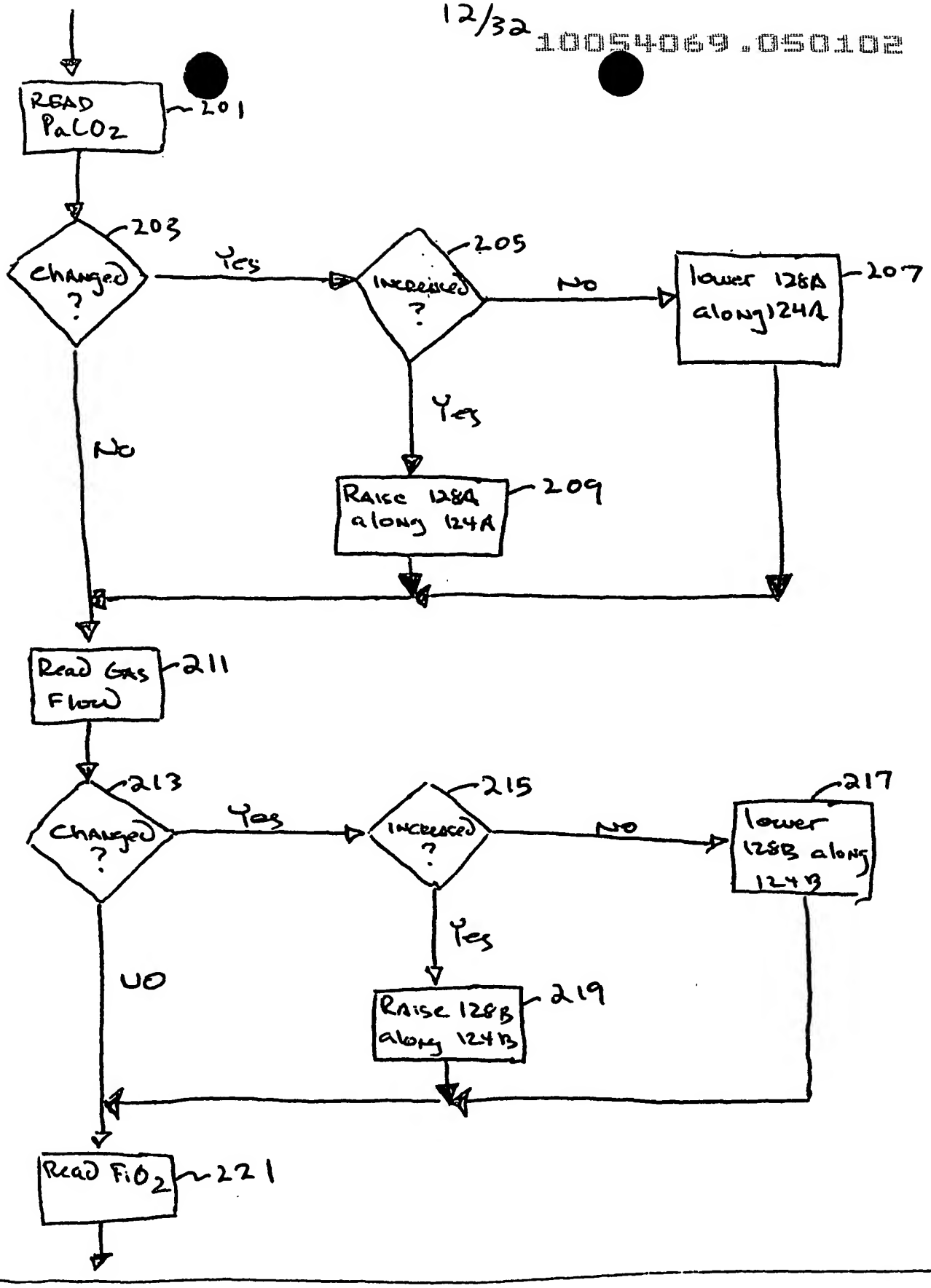
Fig. 8


171
START
Read level of venous blood
173
CHANGED ?
175
Yes
INCREASED ?
177
NO
Move object 110 DOWN object 104
179
Yes
NO
Move object 110 UP object 101
181
Pump ON ?
183
NO
object 112 stationary
187
Yes
object 112 rotates
189
Read blood Flow
191
CHANGED ?
193
Yes
INCREASED ?
195
NO
lower line 118 decrease arrows 116
197
Yes
NO
raise line 118; increase arrows 116
199


READ PaCO2
201
CHANGED ?
203
Yes
INCREASED ?
205
NO
lower 128A along 124A
207
Yes
NO
RAISE 128A along 124A
209
Read Gas Flow
211
CHANGED ?
213
Yes
INCREASED ?
215
NO
lower 128B along 124B
217
Yes
NO
RAISE 128B along 124B
219
Read FiO2
221

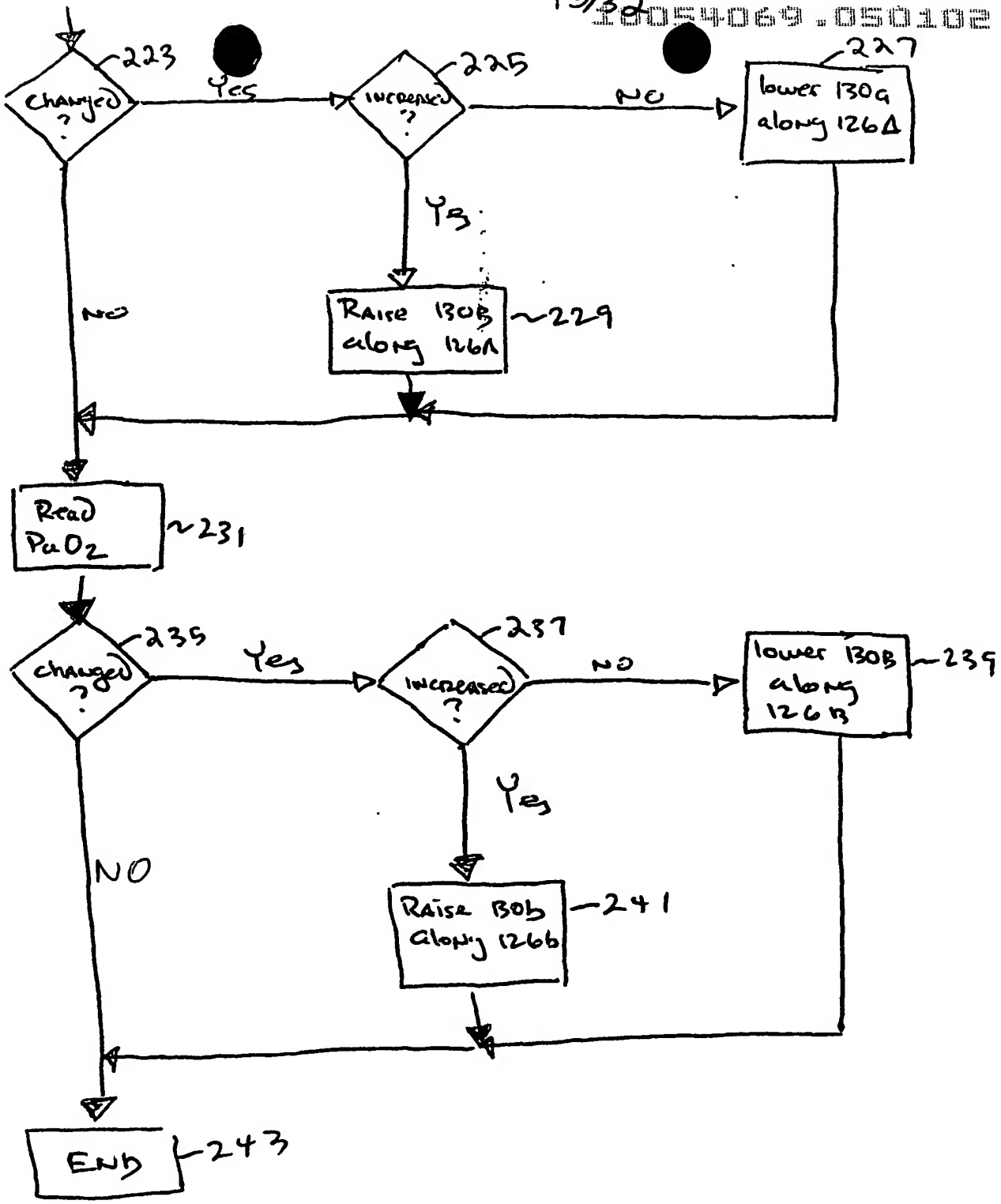

223
Changed ?
Yes
225
Increased ?
NO
227
lower 130A along 126A
Yes
NO
Raise 130B along 126A
229
Read PuO2
231
235
changed ?
Yes
237
Increased ?
NO
lower 130B along 126B
239
Yes
NO
Raise B0b along 126b
241
END
243

Fig. 9

Ventilator State Representation

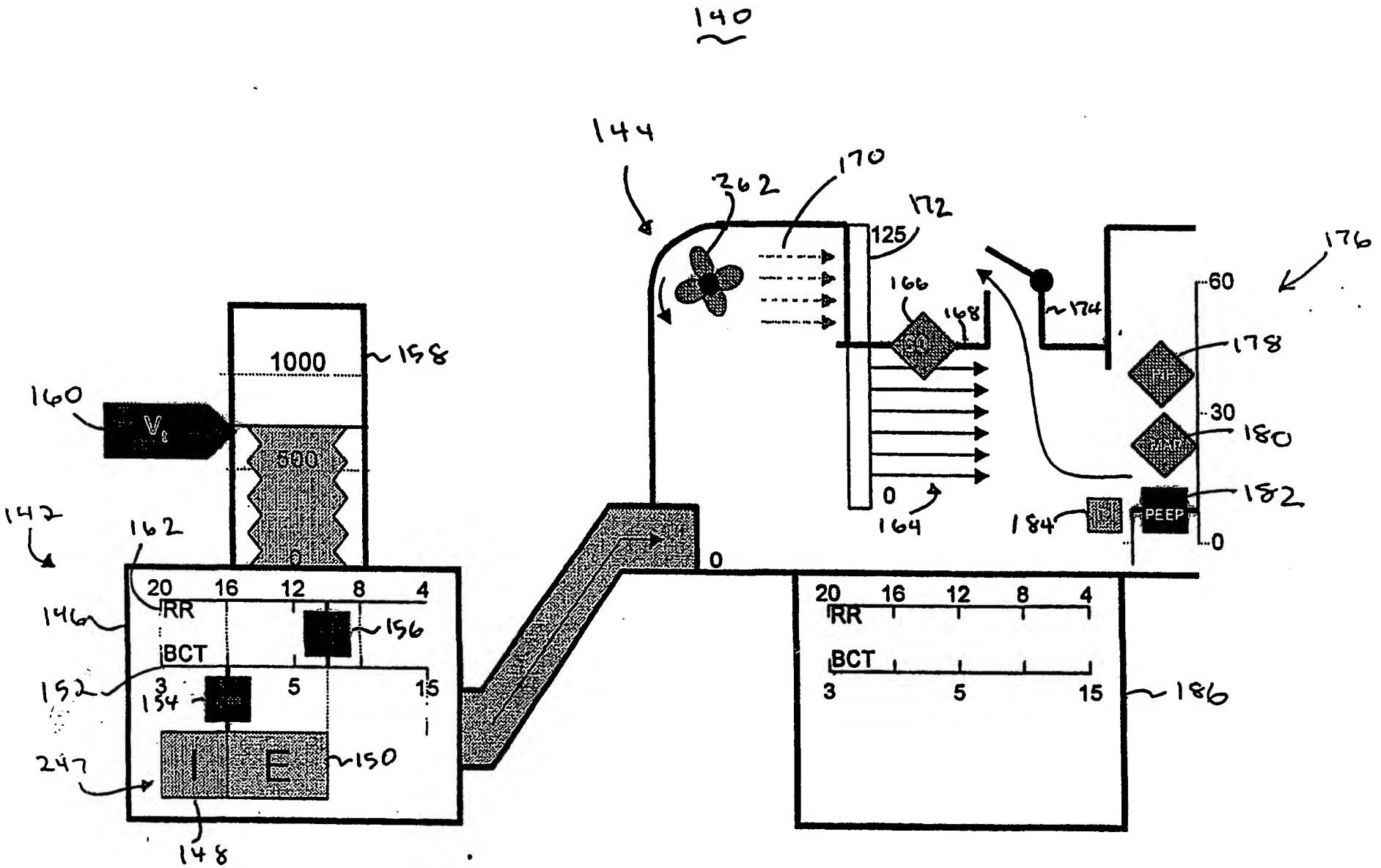


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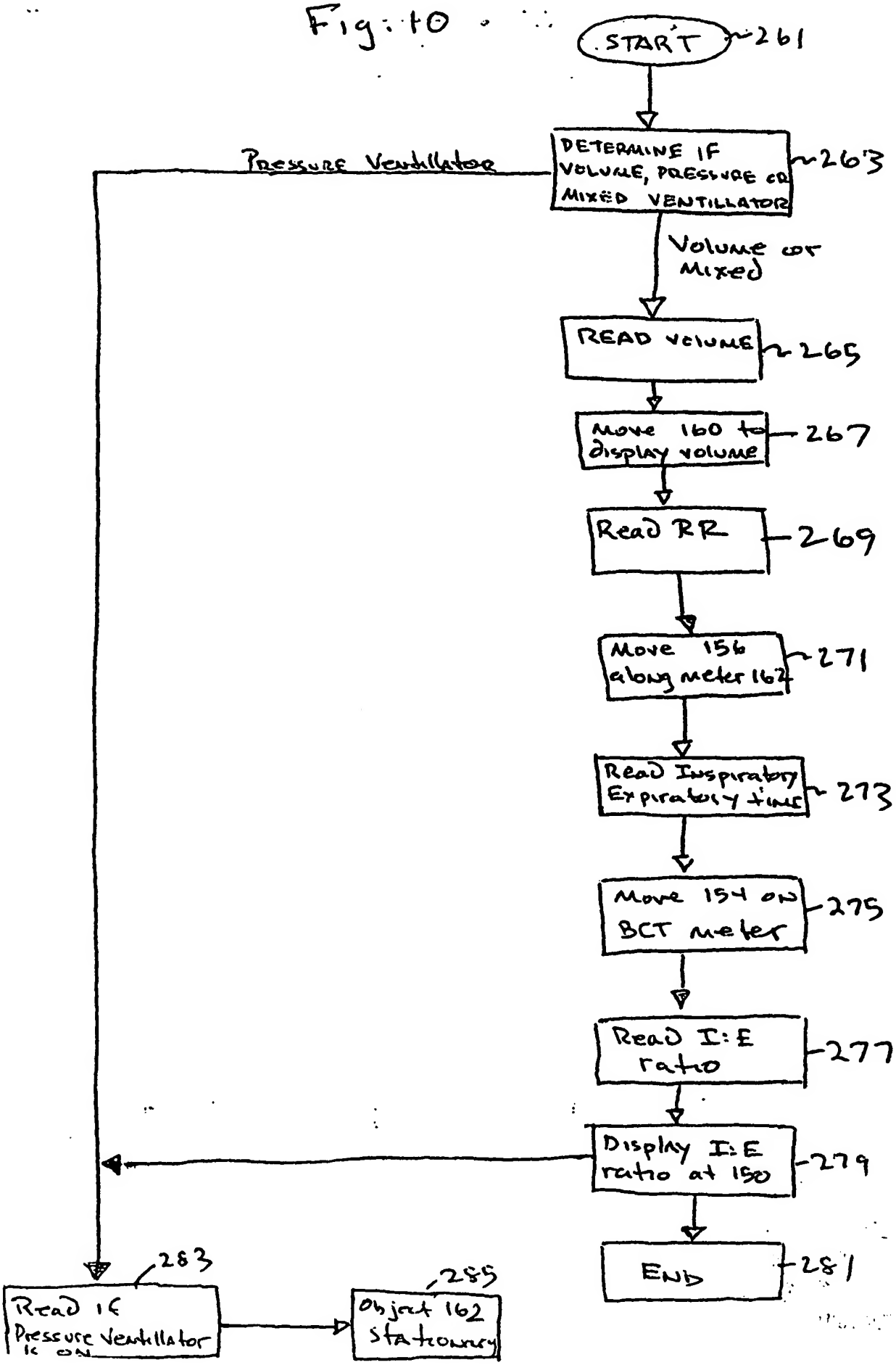
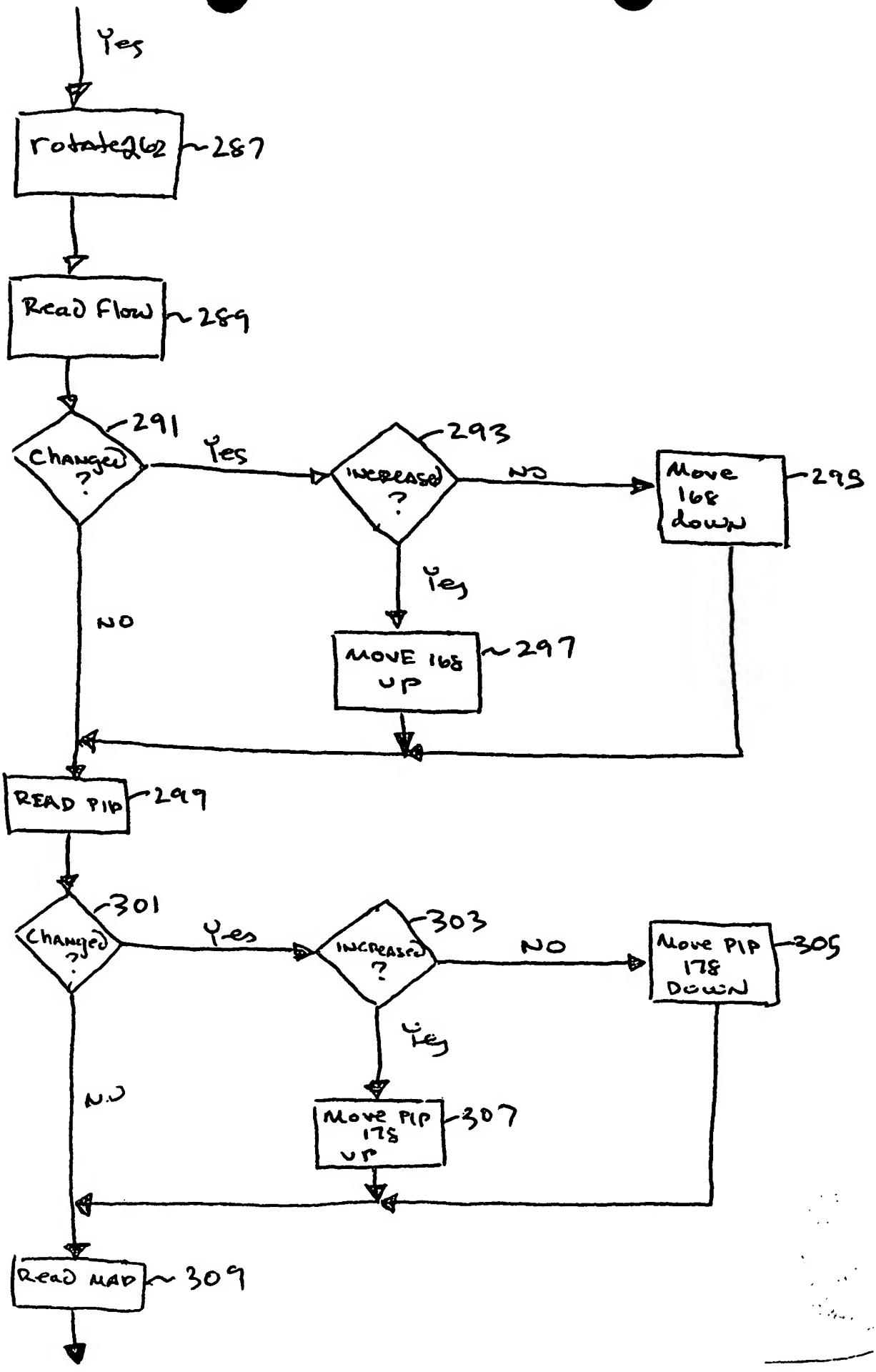
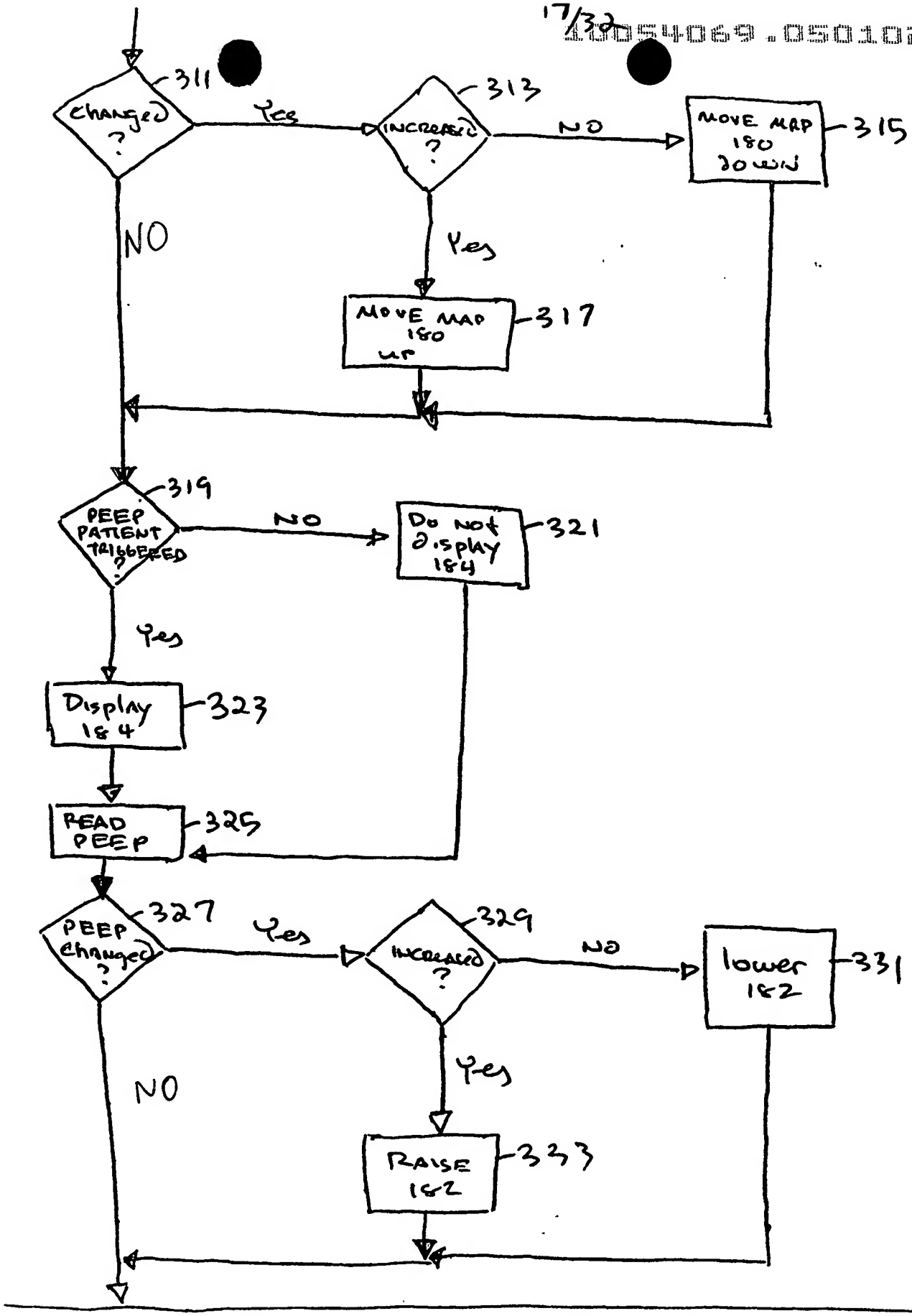
Fig: 10




Yes
Rotate 262
287
Read Flow
289
Changed ?
291
Yes
Increased ?
293
NO
Move 168 down
295
Yes
NO
Move 168 up
297
READ PIP
299
Changed ?
301
Yes
Increased ?
303
NO
Move PIP 178 Down
305
Yes
N.O
Move PIP 178 up
307
Read MAD
309


311
CHANGED ?
Yes
313
INCREASED ?
NO
MOVE MAP 180 DOWN
315
NO
Yes
MOVE MAP 180 UP
317
319
PEEP PATIENT TRIGGERED ?
NO
Do not display 184
321
Yes
Display 184
323
READ PEEP
325
327
PEEP Changed ?
Yes
329
INCREASED ?
NO
lower 182
331
NO
Yes
RAISE 182
333

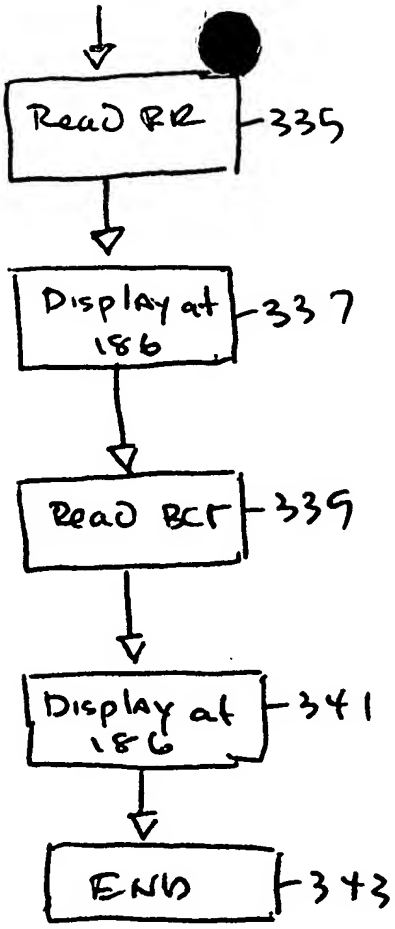

Read RR
335
Display at 186
337
Read BCT
339
Display at 186
341
END
343

Fig. 11

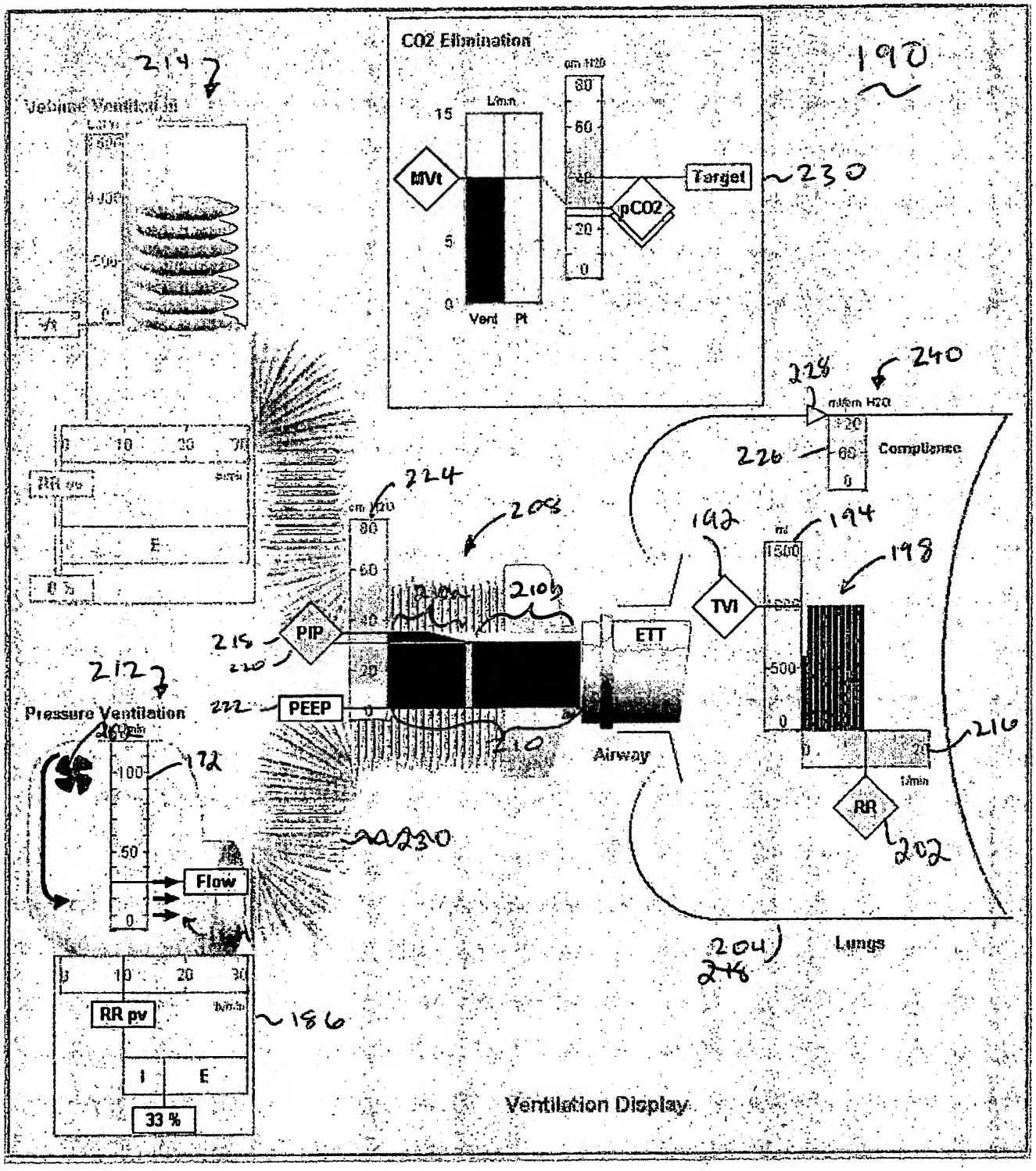

CO2 Elimination
MVt
Target
pCO2
Vent
Pt
Volume Ventilation
Compliance
TVI
PIP
PEEP
ETT
Airway
Lungs
Pressure Ventilation
Flow
RR pv
RR
33 %
Ventilation Display

Fig. 12

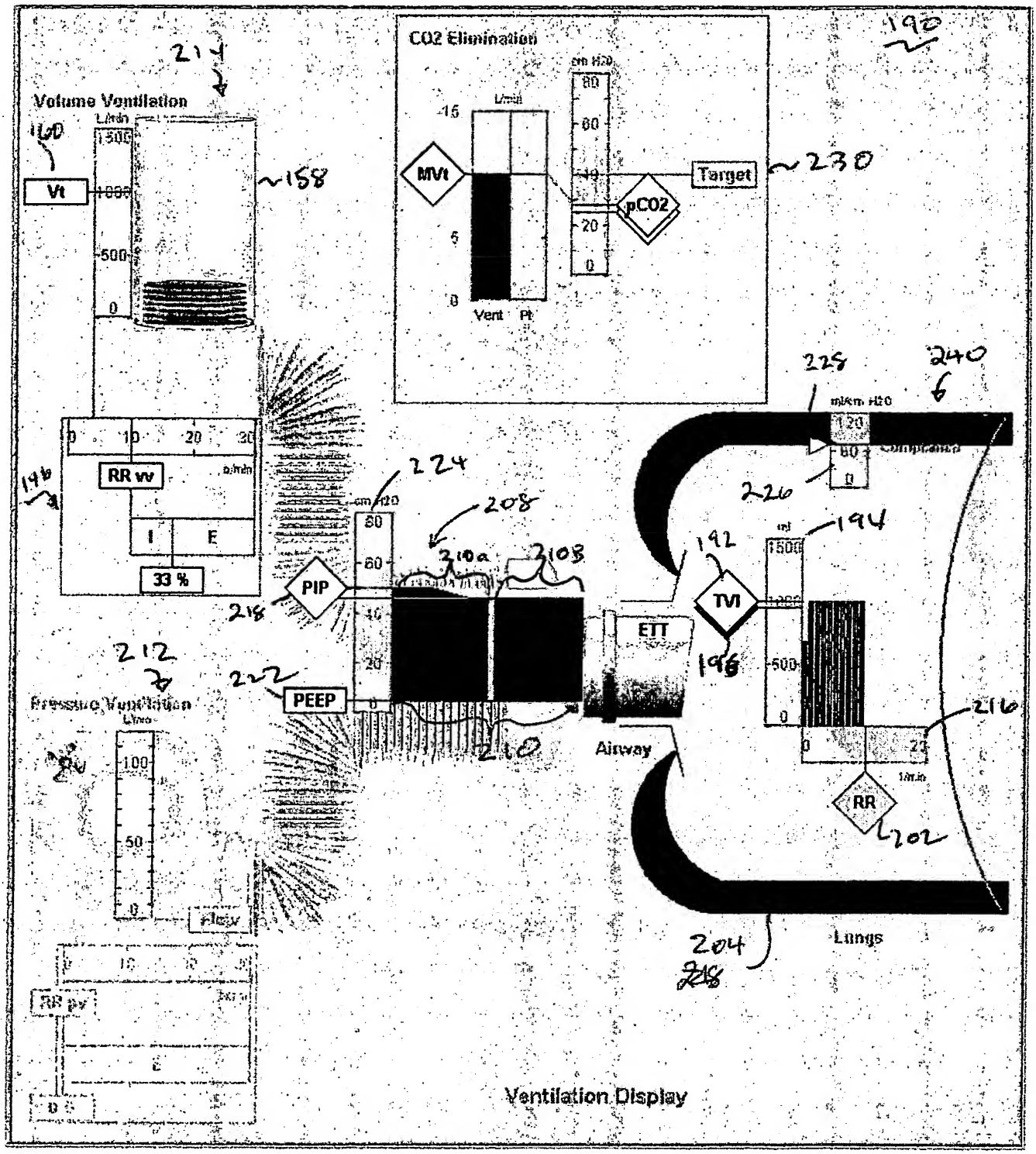

CO2 Elimination
190
Volume Ventilation
214
160
Vt
158
MVt
Target
230
pCO2
Vent
Pt
225
240
Compliance
226
224
208
210a
210b
PIP
218
PEEP
222
212
ETT
192
194
TVi
196
Airway
216
RR
202
204
Lungs
Pressure Ventilation
200
RR vv
I
E
33 %
Ventilation Display

Fig. 13

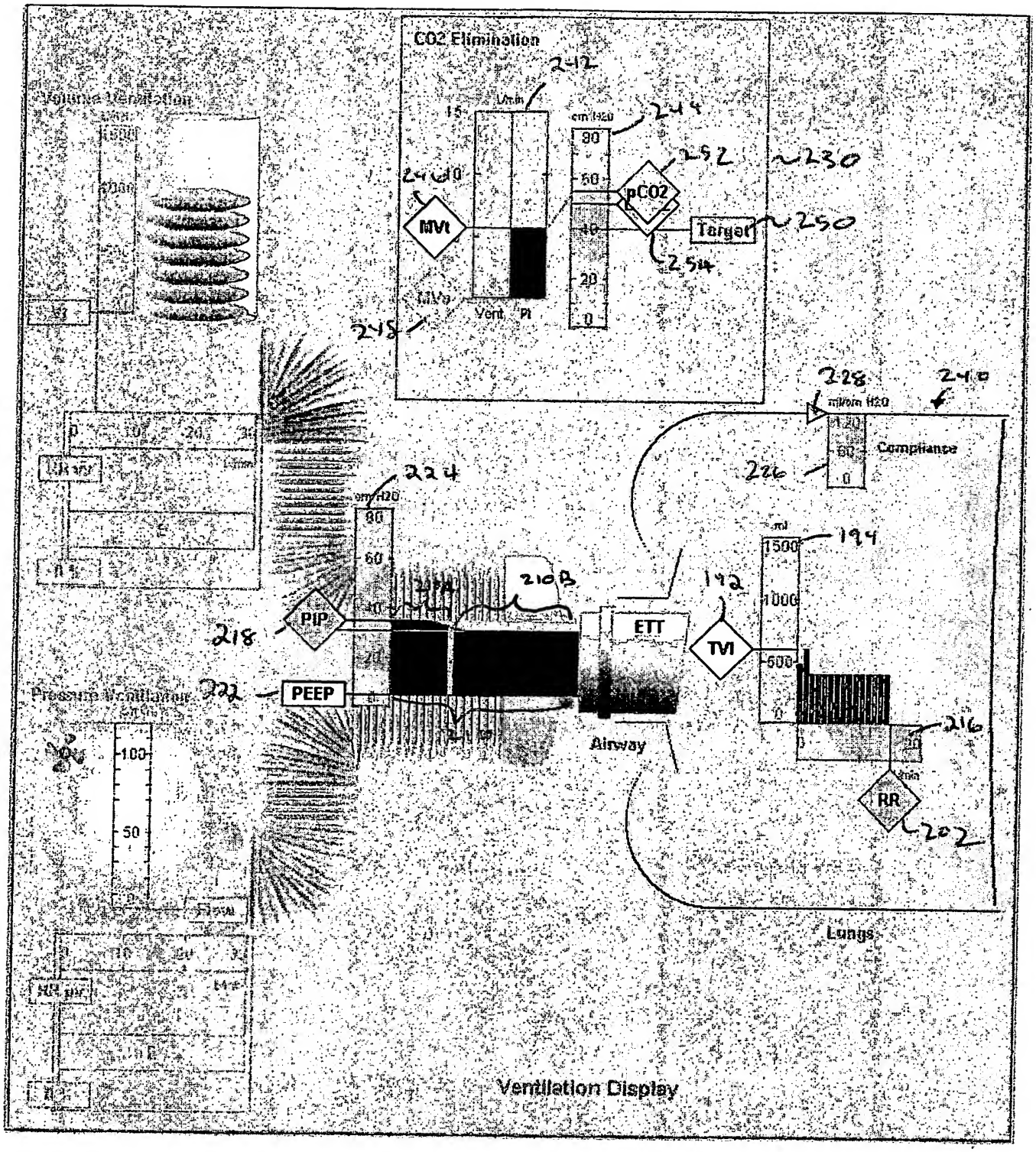
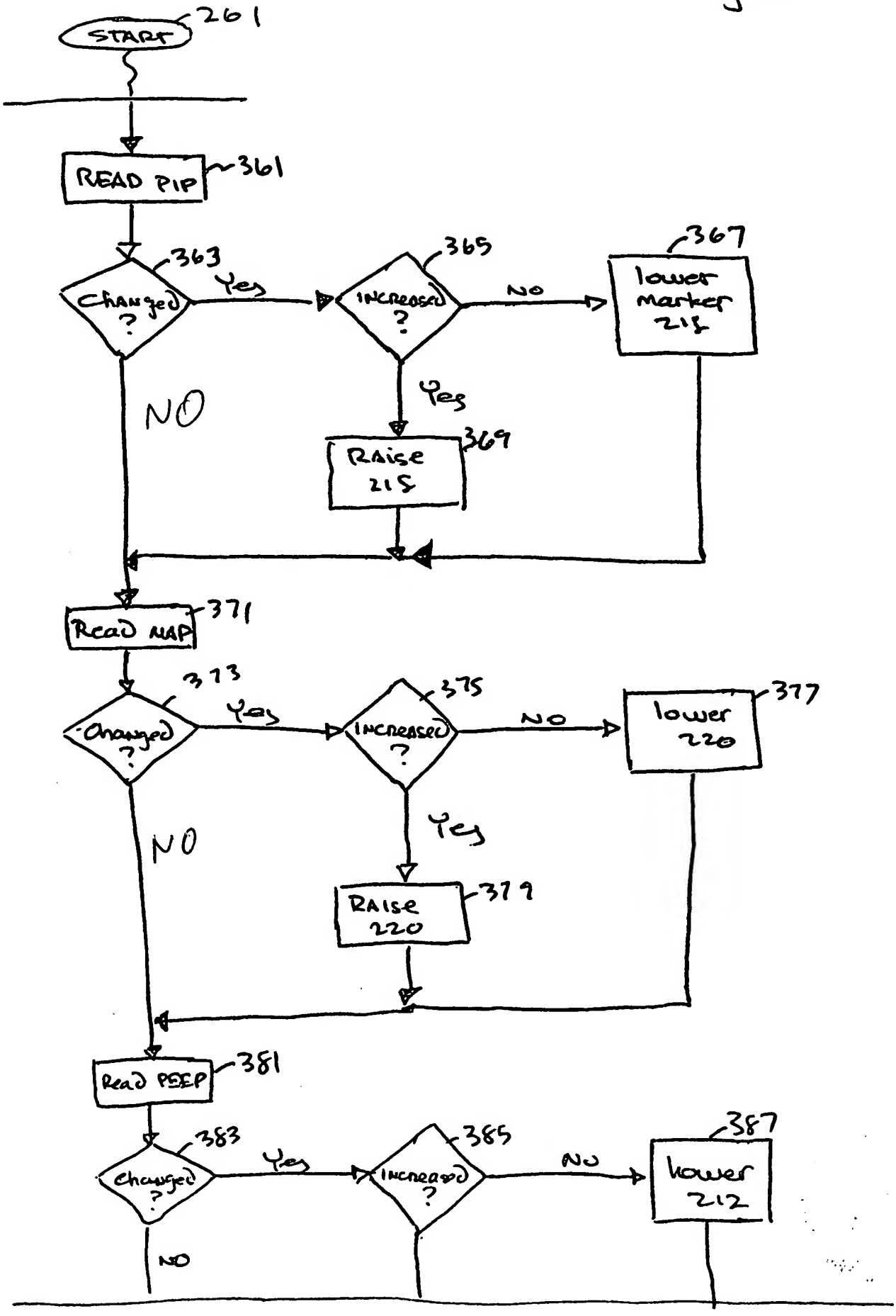
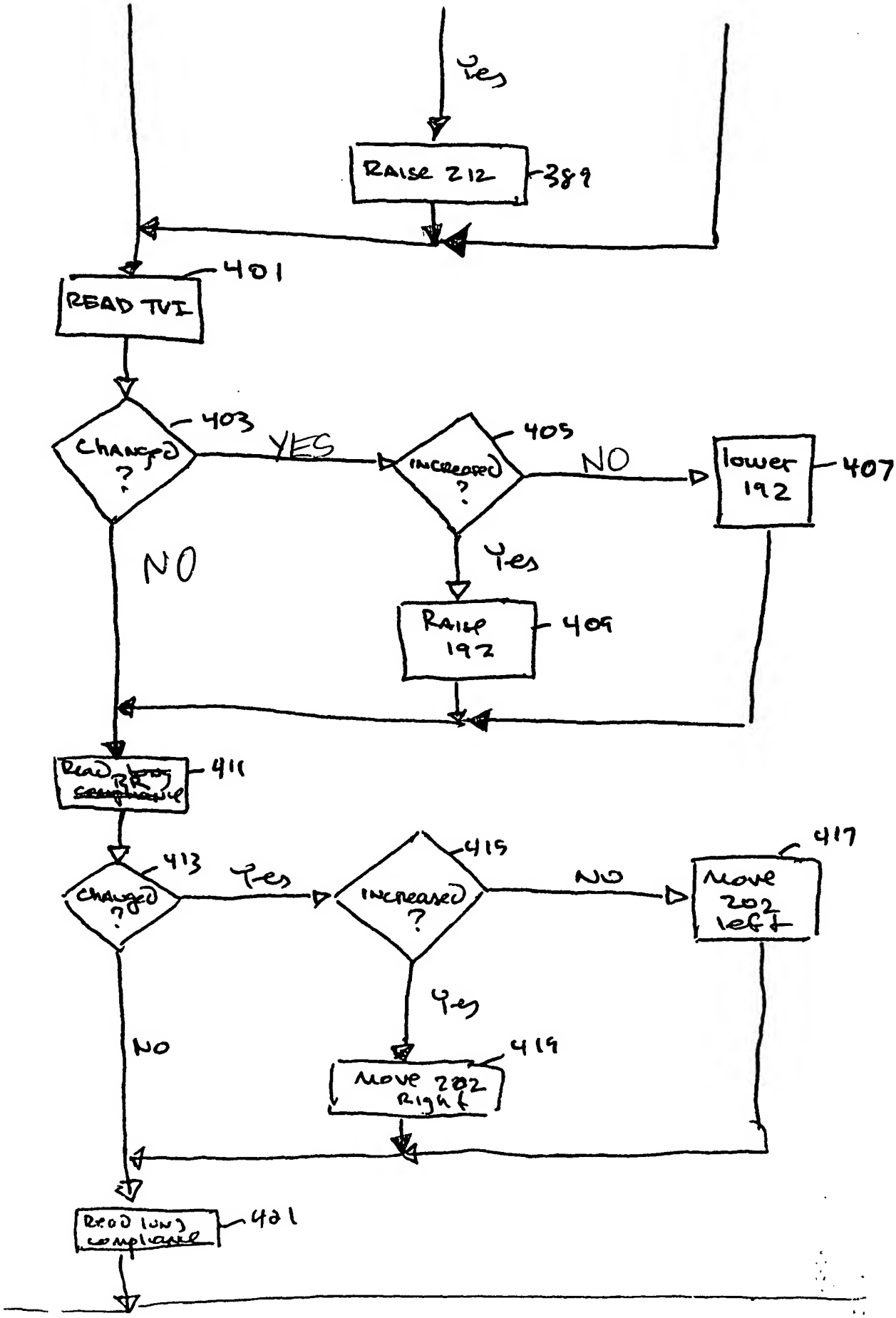
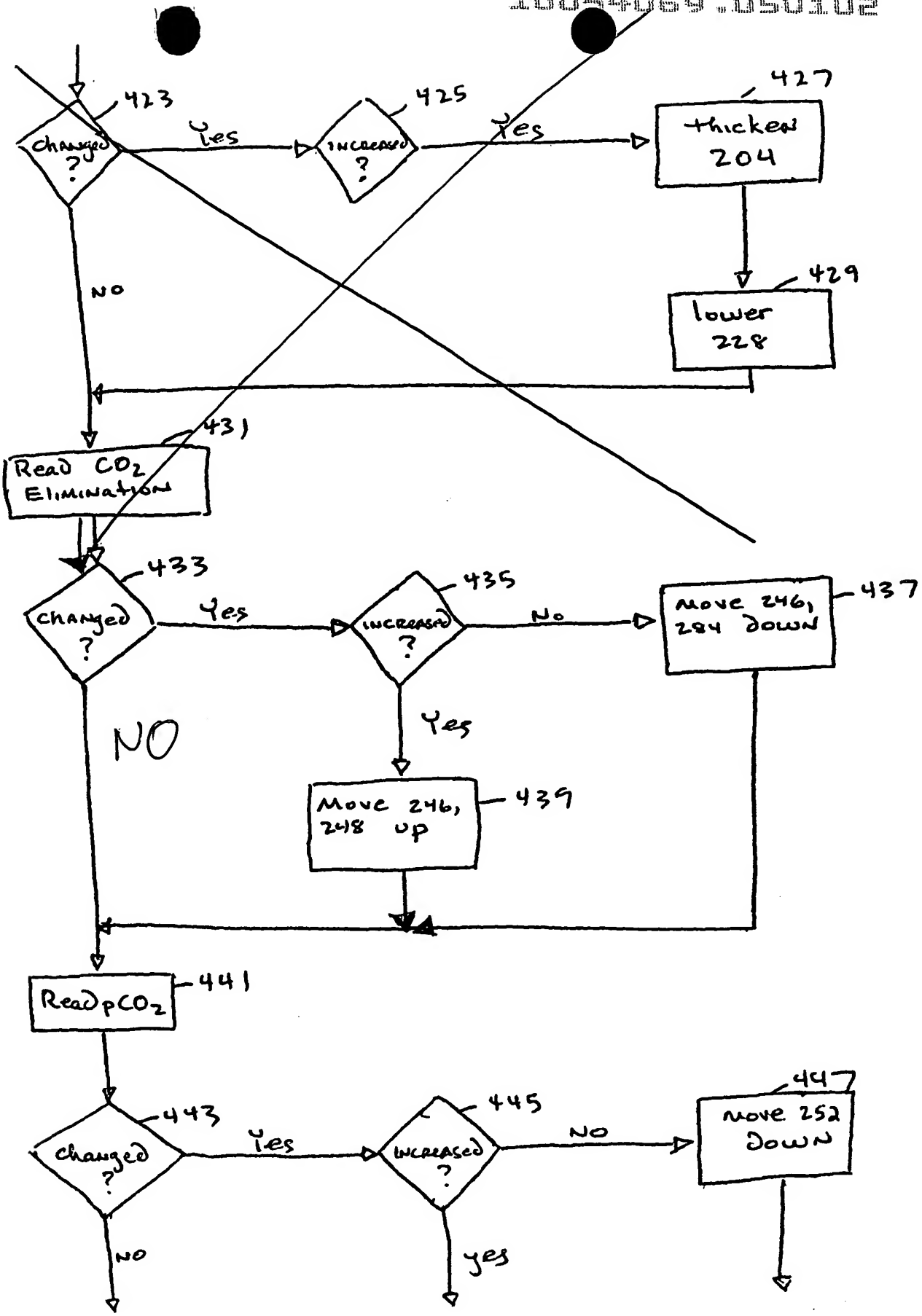

CO2 Elimination
212
Vol/min
15
cm H2O
214
90
60
40
20
0
240
MVt
MVe
Vent
Pt
pCO2
252
230
Target
250
254
248
Volume Ventilation
228
240
cm H2O
120
60
0
Compliance
226
224
cm H2O
80
60
40
20
0
210A
210B
PIP
218
PEEP
222
ETT
192
TVI
ml
1500
1000
500
0
194
216
RR
202
Airway
Lungs
Pressure Ventilation
100
50
0
Flow
Ventilation Display

Figure 14


START
261
READ PIP
361
Changed ?
363
Yes
INCREASED ?
365
NO
lower marker 215
367
NO
Yes
Raise 215
369
Read MAP
371
Changed ?
373
Yes
INCREASED ?
375
NO
lower 220
377
NO
Yes
Raise 220
379
Read PEEP
381
Changed ?
383
Yes
INCREASED ?
385
NO
lower 212
387
NO


Yes
RAISE 212
389
401
READ TVI
403
CHANGED ?
YES
405
INCREASED ?
NO
lower 192
407
NO
Yes
RAISE 192
409
411
413
CHANGED ?
Yes
415
INCREASED ?
NO
417
MOVE 202 left
Yes
NO
419
MOVE 202 Right
401


423
Changed ?
Yes
425
Increased ?
Yes
427
thicken 204
429
lower 228
NO
431
Read CO_2 Elimination
433
Changed ?
Yes
435
Increased ?
No
437
Move 246, 284 down
NO
Yes
439
Move 246, 248 up
441
Read pCO_2
443
Changed ?
Yes
445
Increased ?
NO
447
Move 252 down
NO
yes

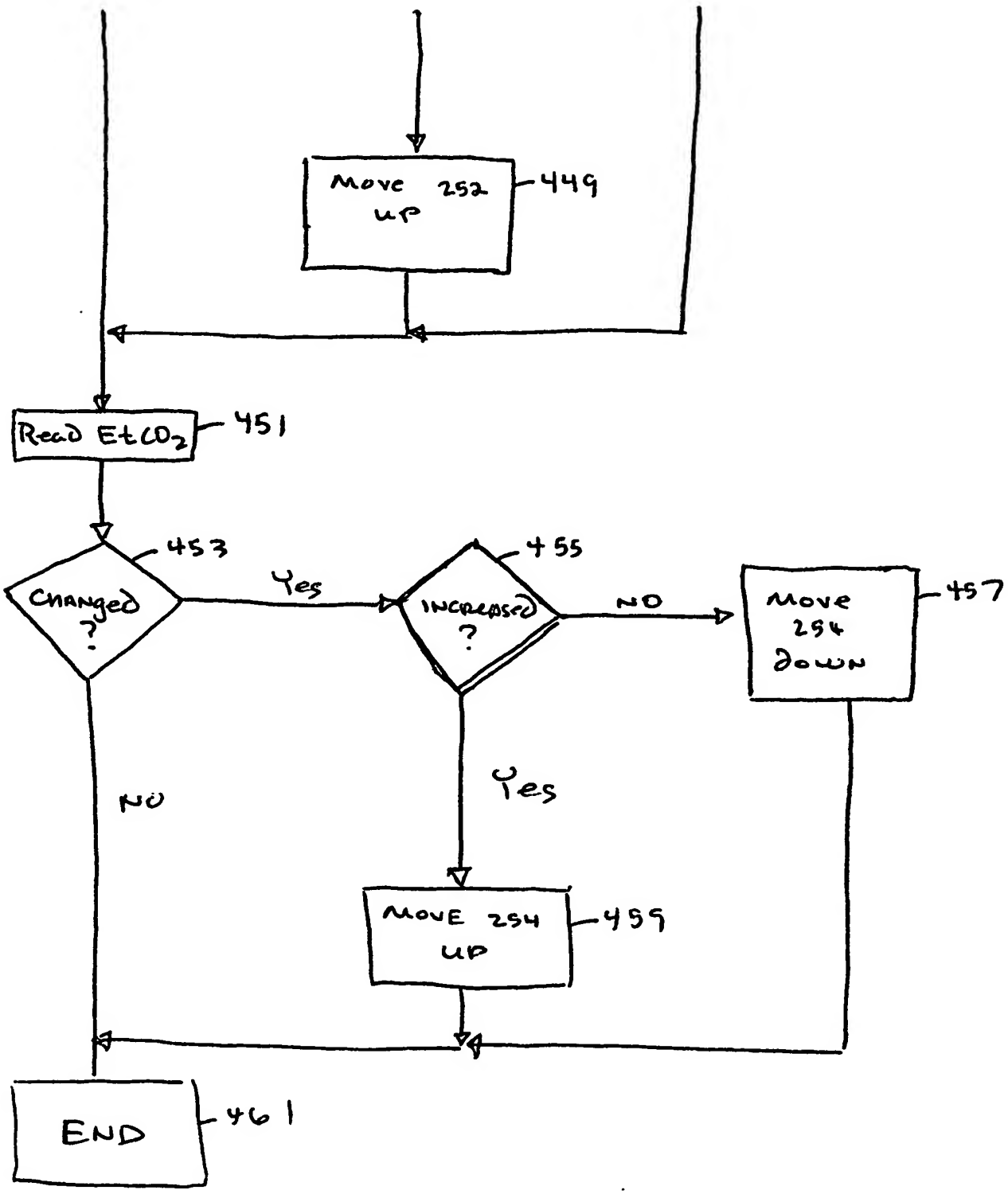

Move 252 UP
449
Read $EtCO_2$
451
453
Changed ?
Yes
455
Increased ?
NO
Move 254 Down
457
NO
Yes
Move 254 UP
459
END
461

Fig. 15

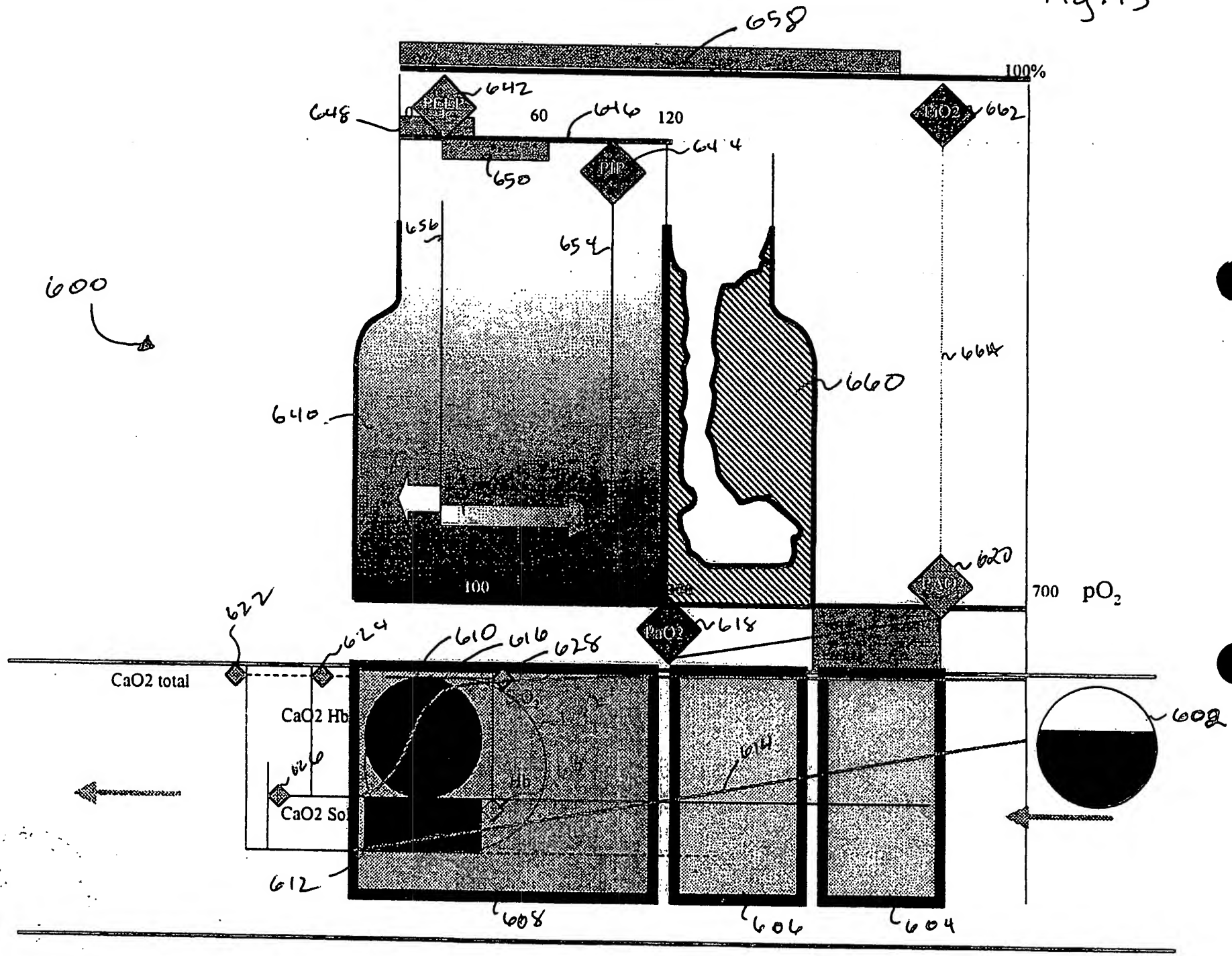


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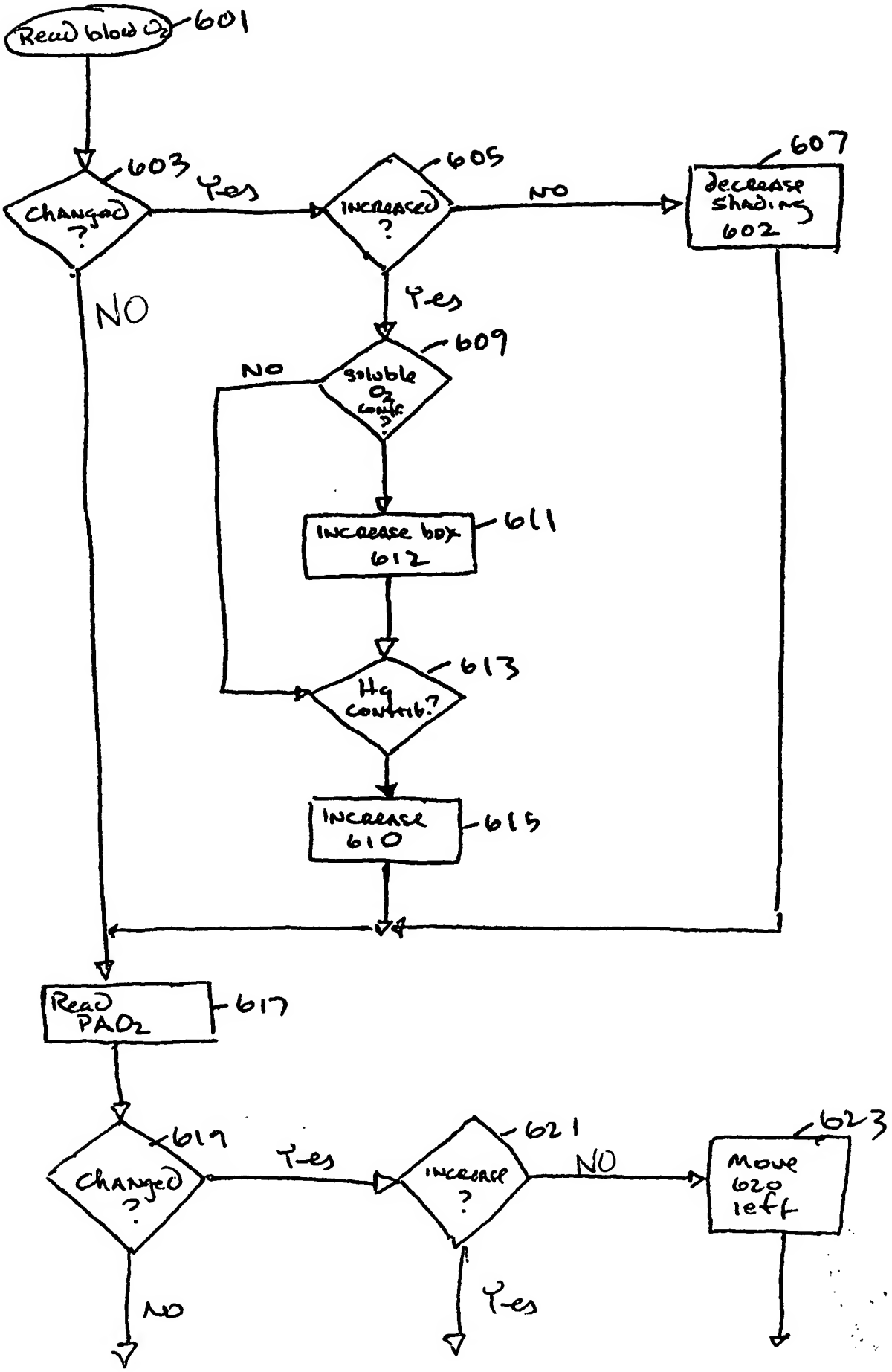
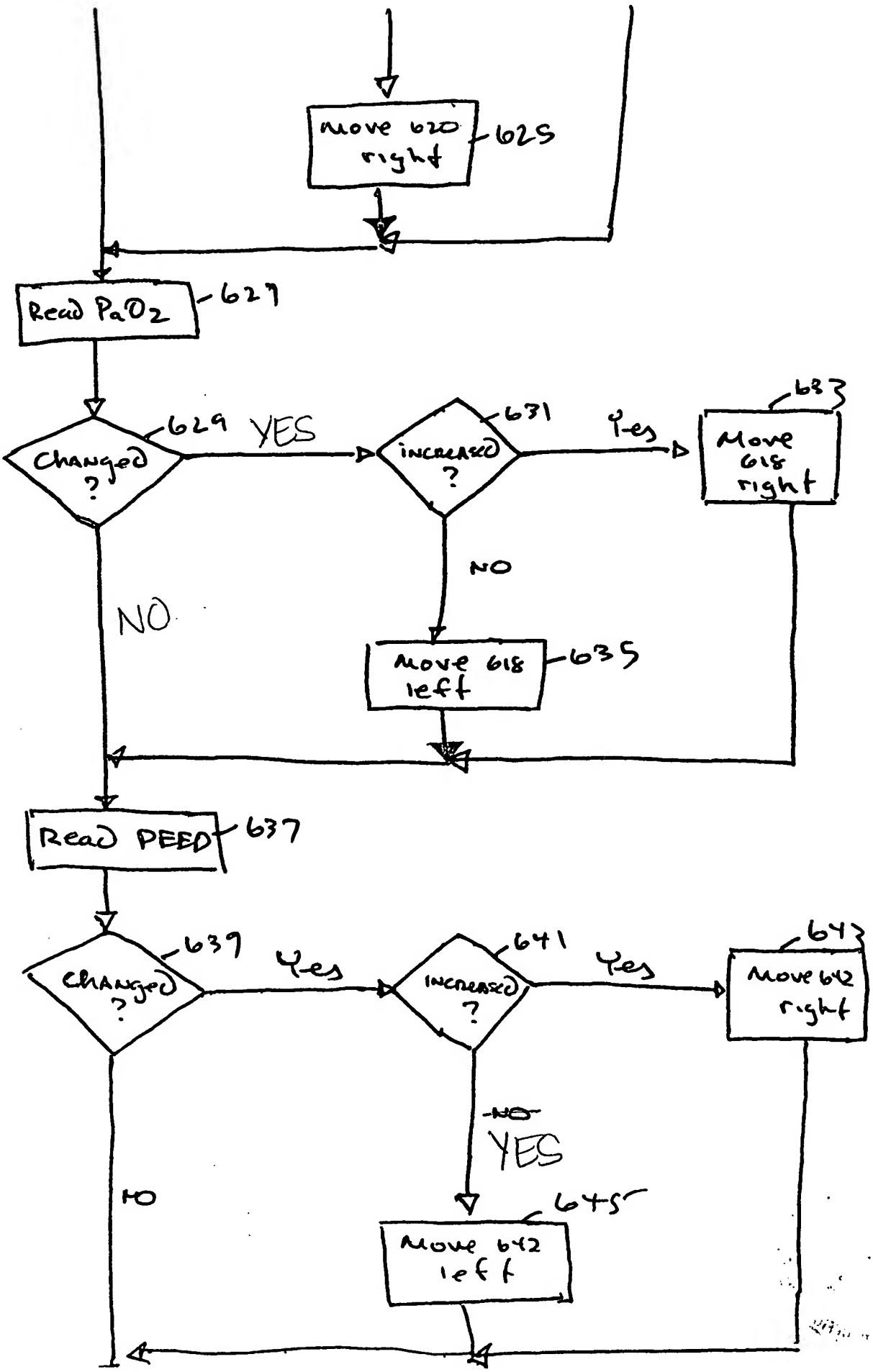
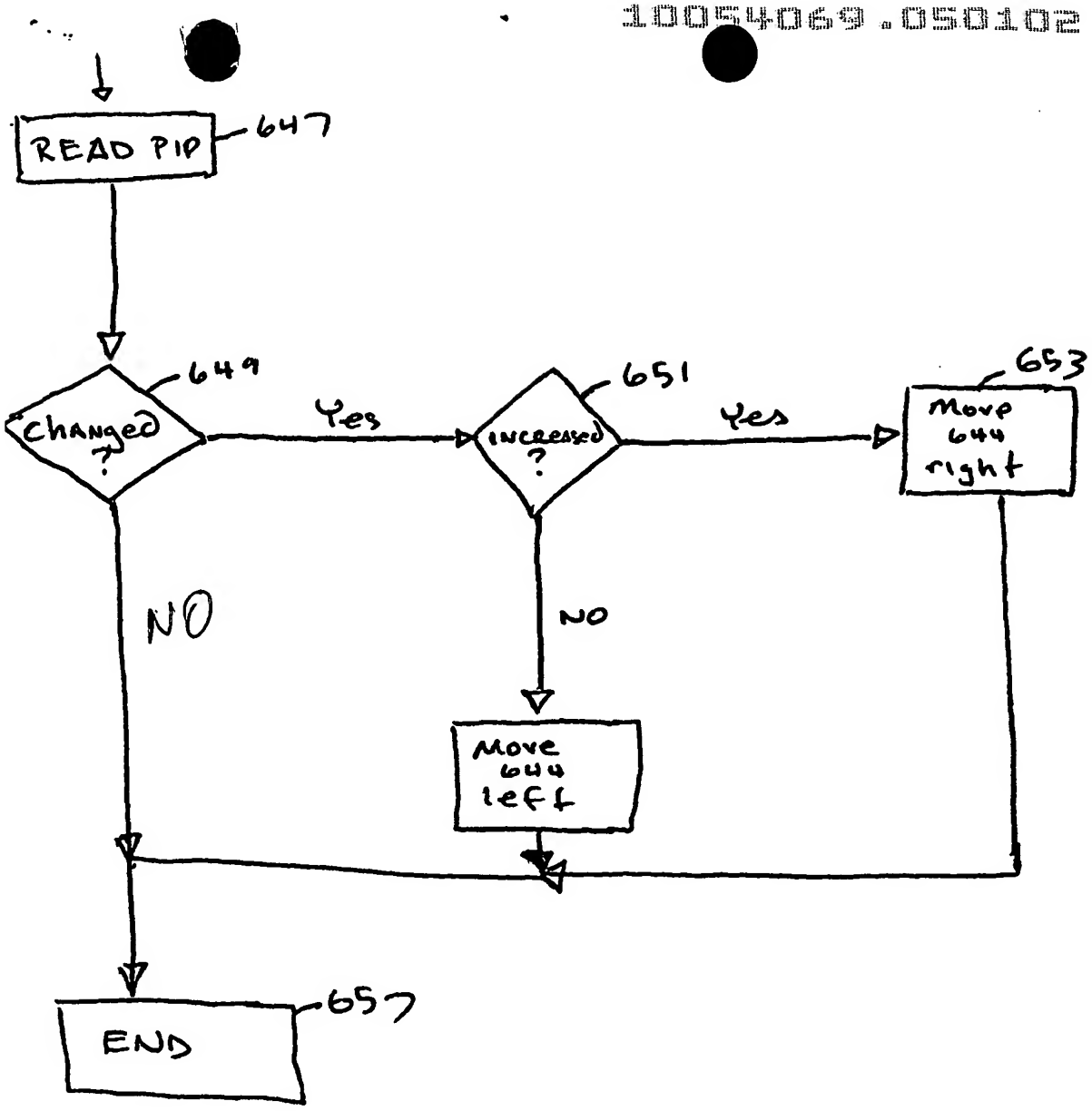
Fig. 16


Read blood O2
601
Changed ?
603
Yes
NO
INCREASED ?
605
NO
decrease shading 602
607
Yes
soluble O2 comp ?
609
NO
INCREASE box 612
611
Hg contrib?
613
INCREASE 610
615
Read PAO2
617
Changed ?
619
Yes
NO
INCREASE ?
621
NO
Yes
Move 620 left
623


Move 620 right
625
Read P_aO_2
627
Changed ?
629
YES
INCREASED ?
631
Yes
Move 618 right
633
NO
NO
Move 618 left
635
Read PEEP
637
CHANGED ?
639
Yes
INCREASED ?
641
Yes
Move 642 right
643
NO
YES
NO
Move 642 left
645


READ PIP
647
649
CHANGED ?
Yes
651
INCREASED ?
Yes
653
Move 644 right
NO
NO
Move 644 left
END
657

10054069.050102

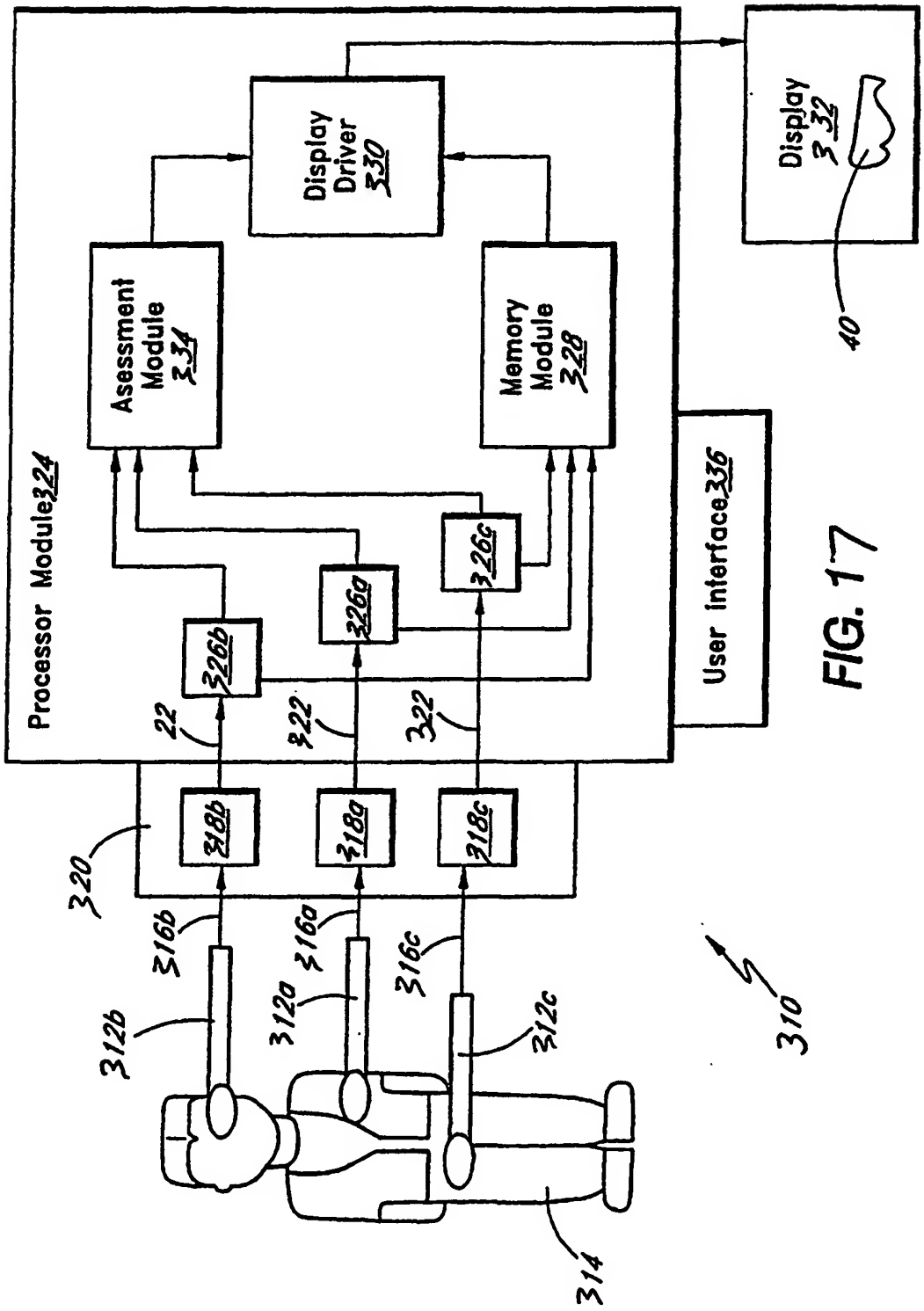


FIG. 17

10054069 .050102

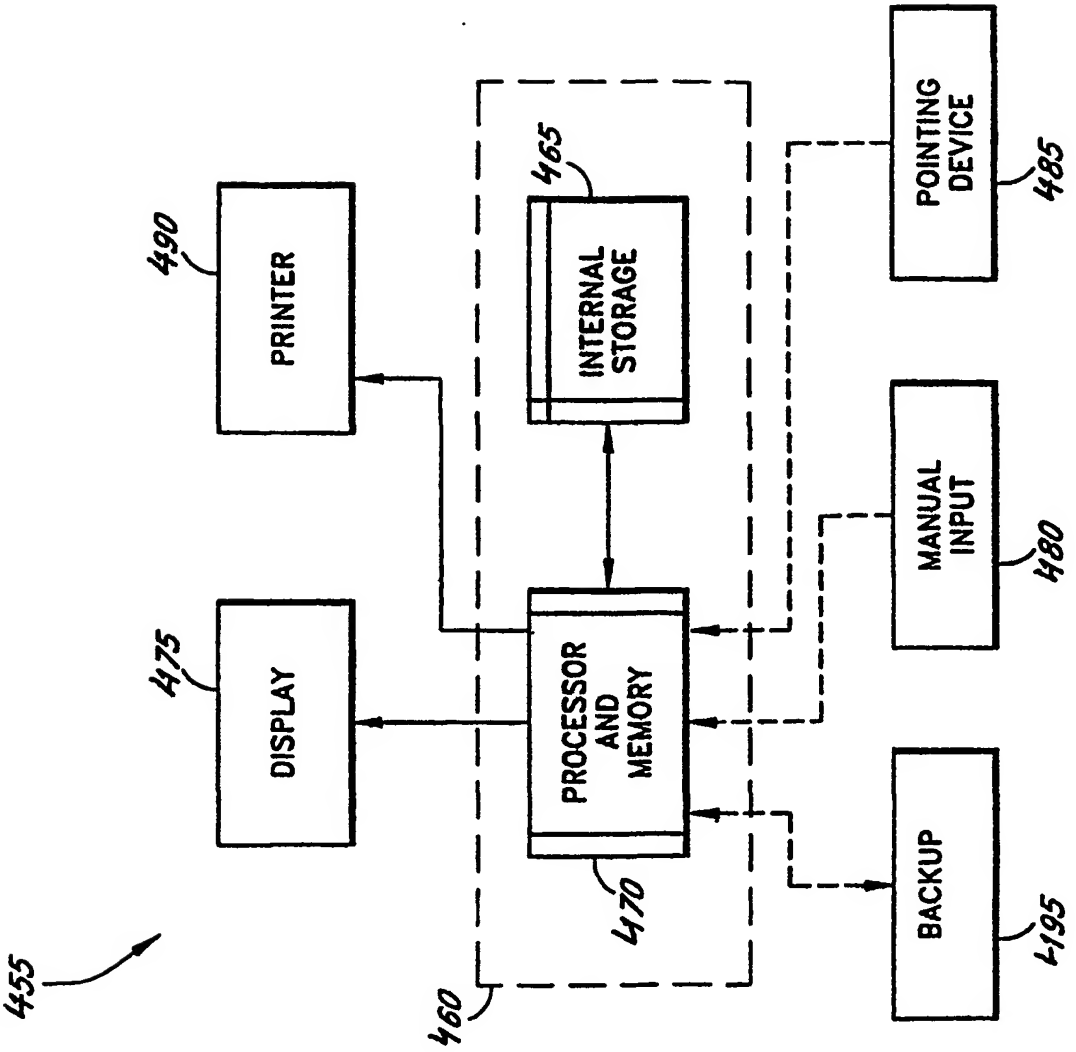


FIG. 18

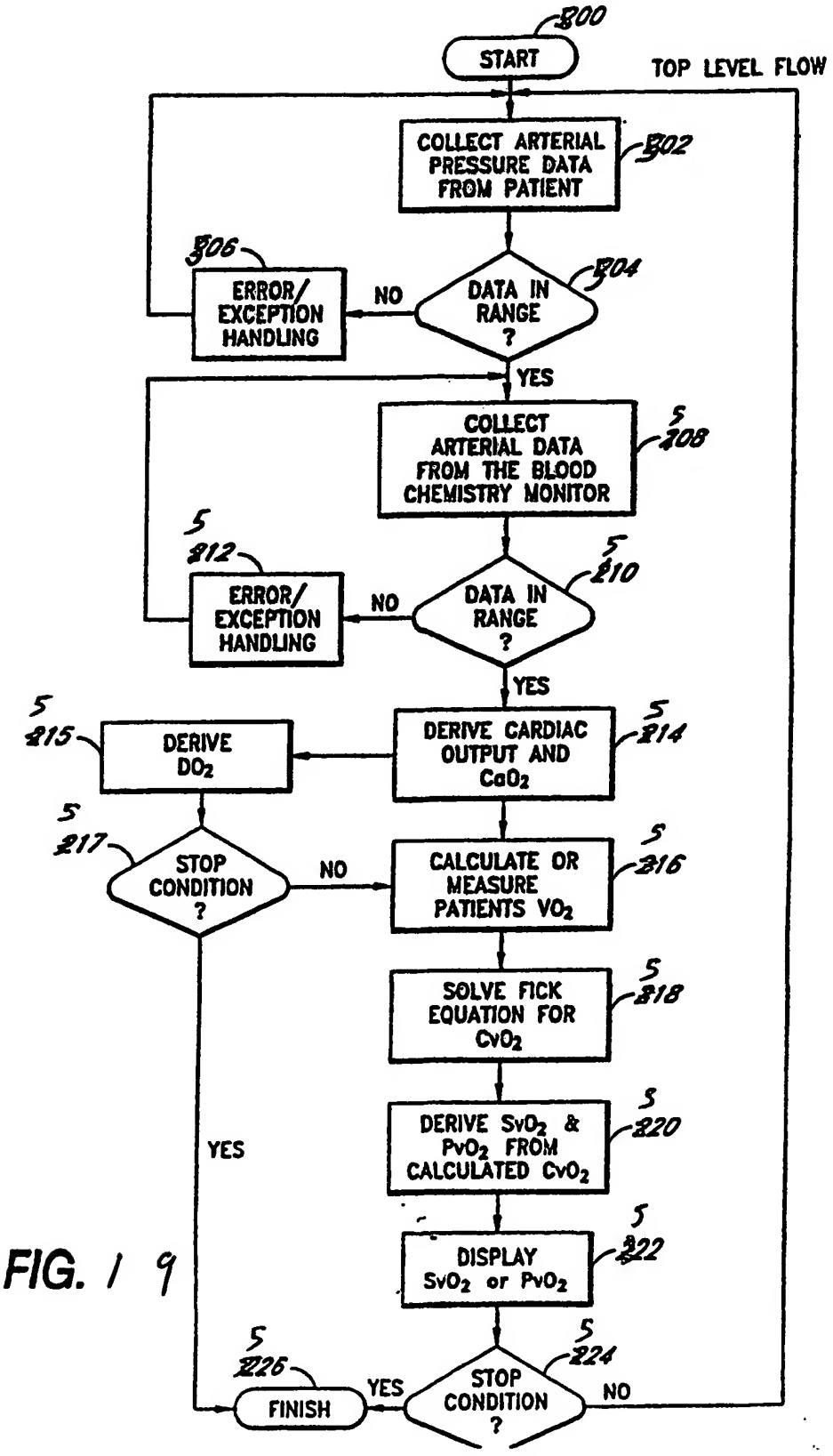

300
START
TOP LEVEL FLOW
COLLECT ARTERIAL PRESSURE DATA FROM PATIENT
302
DATA IN RANGE ?
304
NO
ERROR/ EXCEPTION HANDLING
306
YES
COLLECT ARTERIAL DATA FROM THE BLOOD CHEMISTRY MONITOR
308
DATA IN RANGE ?
310
NO
ERROR/ EXCEPTION HANDLING
312
YES
DERIVE CARDIAC OUTPUT AND CaO2
314
DERIVE DO2
315
STOP CONDITION ?
317
NO
CALCULATE OR MEASURE PATIENTS VO2
316
SOLVE FICK EQUATION FOR CvO2
318
DERIVE SvO2 & PvO2 FROM CALCULATED CvO2
320
YES
DISPLAY SvO2 or PvO2
322
STOP CONDITION ?
324
NO
YES
FINISH
326

FIG. 19